UNIVERSITY OF OKLAHOMA

GRADUATE COLLEGE

CONNECTING PEDAGOGY, TECHNOLOGY, AND CONTENT IN VIRTUAL EARLY CHILDHOOD

A DISSERTATION

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY IN EARLY CHILDHOOD EDUCATION

BY

BRANDY-LEA SUZANNE MCCOMBS
Norman, Oklahoma
2022

Downloaded from SHAREOK. Persistent Handle URL: https://hdl.handle.net/11244/335825

CONNECTING PEDAGOGY, TECHNOLOGY, AND CONTENT
IN VIRTUAL EARLY CHILDHOOD

A DISSERTATION APPROVED FOR THE
DEPARTMENT OF INSTRUCTIONAL LEADERSHIP AND ACADEMIC CURRICULUM

BY THE COMMITTEE CONSISTING OF

Dr. Vickie E. Lake, Chair

Dr. Beverly Edwards-Poteet

Dr. Libby Ethridge

Dr. Diane Horm

©Copyright by BRANDY-LEA SUZANNE MCCOMBS 2022
All Rights Reserved.

DEDICATION

If it hasn't been in the hand, the body and heart, it can't be in the brain.

-Bev Bos

This is dedicated to every child who has arrived at school carrying way more baggage than their little arms could hold. May I use my time, journey, and passion to empower the educators who will welcome you into a classroom of acceptance, security, and hope.

And to all the students who have called me "Mrs. McCombs," each of you have made me better and taught me more than you will ever know. Thank you for allowing me to be your teacher.

Acknowledgements

Who in their right state of mind would ever encourage anyone to return to college at age 41? Not I. Well, okay, maybe I would. But there I was, age 41, enrolled at the University of Oklahoma (the very university I hoped to attend decades earlier) to pursue my master's degree in school administration. As my course work was coming to an end, I realized I was meant for more and OU-Tulsa was the perfect avenue.

I simply cannot wrap my brain around that only three years and eight months ago I sat in my first Ph.D. level course and here I am today finalizing my dissertation. There are so many selfless people who have poured their time, energy, and support into my heart. Brandon, ever since I started my journey as a teacher, you have always encouraged me and saw me far beyond how I ever saw myself. You have always paved the way for me to cast my dreams and you have been the very one cheering me on and celebrating every accomplishment along the way. Thank you. My four boys: Kolby, Cooper, Cayden, and Korbin. Words cannot express the gratitude I have in my heart for each of you. The understanding each of you have had when I missed a game, fed you dinner off paper plates, struggled to pay deep attention to you as my mind raced about a looming deadline…sigh. I have battled Mom Guilt along this process but each of you continue to erase it with the support, love, encouragement, and belief you place in me. Thank you.

I cannot comprehend the amount of support that has been lavished on me from my family. Our parents stepping up to help with kids' schedules and encouraging phone calls and emails. I am beyond grateful for my BFF's who have prayed for me, encouraged me, and celebrated with me along this journey. Girls, I am SO ready for a girl trip…..*SCHEDULE IT!* And to my Grove Family who kept encouraging me with donations of paper, kind text messages,

words in the hallway, and "You can do it!" Each act was fuel and motivation to keep going and not give up. My soccer families. The amount of typing, reading, and researching I have done on the sidelines, in the hotel rooms, and in the car…blah…all the while I missed out on conversations, laughs, and memories…not anymore! Thank you for loving me and joining me in the conversations when I would pop in for a bit and then hide back in the room just "to finish one more paper"! Finally, my church family. Thank you for being so incredibly understanding and supportive along the way. The continued "check-ins" and support do not go unnoticed or unappreciated. I am incredibly grateful for our church.

To the faculty at OU-Tulsa. There were many times along this journey I borrowed what each of you saw in me. I would keep telling myself, "Surely, if I don't belong, Dr. Lake would tell me or just ask me to leave." Yet, each of you kept giving me encouragement and A's so I kept moving forward. Thank you for believing in me and empowering me to be me.

Dr. Lake, I was beyond intimidated by you when I sat across your desk the first time and you mapped out a plan from my first class to graduation. A little voice in my head whispered, "Why not try?" I am so glad I did. Thank you for pushing me and challenging my thought process. Ultimately, thank you for believing in me and thank you for supporting me beyond the realms of *Committee Chair,* especially since January of 2022.

Dr. Edwards-Poteet, I remember my first master's level class I had with you. Immediately, I was drawn to you and your spirit. Your selflessness and positivity are magnetic and beyond inspirational. Thank you for seeing in me what I only hope to see one day. I respect you and I am forever grateful our paths have crossed.

Dr. Ethridge, thank you for entrusting me with our undergrads, our future teachers. I accepted this act as an honor and a huge responsibility. Thank you for even seeing me worthy to

pour into future teachers and teach them the ropes as they prepare to embark on their own journeys. I am forever grateful for your belief in me.

Dr. Horm, thank you for being so incredibly positive and real. Through taking your classes and you serving on my committee, your presence radiates positivity along with reality, two attributes in education which are greatly needed. Thank you for pouring into my journey and supporting me along the way. I am incredibly grateful.

Dr. Kwon, I remember sitting in your class the very first night. I felt so out of my league. The vocabulary. The connections. The applications. Yet there you stood smiling and encouraging me with your words. I will forever be grateful for your welcomeness to allow me to break down in your presence. Thank you for allowing me to exhale and regroup. I appreciate you.

I want to thank the OWLS and the OWLS who finished before me. The comradery and support here at OU-Tulsa is unique, rare, and priceless. I truly believe in my heart this is why I was meant to be here. God knew I would not have finished without the framework set up by Dr. Lake and the environment of love, support, encouragement, and belief we pour into each other. Thank you for making me better and supporting me along this journey.

Finally, to my God. At the age of 14 when I abandoned the idea of religion and began a relationship is when I knew that I knew I had purpose in life. I had hope. I had joy. This journey literally could not have been possible without Your provision, protection, and blessing. I pray this degree, this journey, and this knowledge glorifies You and You alone. Nothing for me. I pray I can truly be the vessel which gives hope to the hopeless, peace to the anguished, and purpose for the lost. This journey is Your's….

Table of Contents

List of Tables xi

List of Figures xii

PROLOGUE xiii

Dissertation Abstract xiv

MANUSCRIPT I 1

Abstract 2

Pedagogical Technological Content Connections 5

TPACK Framework 6

DAP Framework 8

Definition of Terms 10

Review of Literature 10

Technology Challenges Teachers Face 12

Methodology 14

Participants and Setting 14

Data Sources and Procedures 16

Findings and Discussion 18

Conclusion 28

References 30

Appendix A 36

MANUSCRIPT II 38

Abstract 39

Virtual Education Gaps 41

Theoretical Framework 42

Definition of Terms 45

Review of Literature 46

Methodology 49

Participants and Setting 49

Data Sources and Procedures 52

Findings and Discussion 55

Conclusion 64

References 69

MANUSCRIPT III 80

Abstract 81

Developmentally Appropriate Practice Guidelines 82

Creating a Caring, Equitable Community of Learners 84

Engaging in Reciprocal Partnerships with Families and Fostering Community Connections 86

Observing, Documenting, and Assessing Children's Development and Learning 87

Teaching to Enhance Each Child's Development and Learning 88

Planning and Implementing and Engaging Curriculum to Achieve Meaningful Goals 90

Demonstrating Professionalism as an Early Childhood Educator 92

References 95

APPENDIX A: PROSPECTUS 97

Connecting Pedagogy, Technology, and Content in Virtual Early Childhood 98
Table of Contents 100
Abstract 102
Chapter 1 103
Introduction 103
Research Problem 106
Research Purpose 107
Research Questions 108
Theoretical Framework 108
Significance of Study 113
Chapter 2 116
Review of Literature 116
Technology Through the Lens of Early Childhood Education 116
Technology Challenges Teachers Face 117
Measuring TPACK 120
Virtual Education Performance 121
Developmentally Appropriate Practice 123
Conclusion 124
Chapter 3 125
Methodology 125
Participants and Setting 125
Qualitative Data Sources and Procedures 127
Quantitative Data Sources and Procedures 130

References 133

Table 1 143

Appendix A 144

Appendix B 148

Appendix C 153

Appendix D 154

Organizational Timeline 155

List of Tables

MANSCRIPT I

Table 1 Survey Participant Distribution 15

MANUSCRIPT II

Table 1 Survey Participant Distribution 50
Table 2 Averages of TPACK Components..... 56

MANUSCRIPT III

Table 1 PreK Activities with Open-Ended Questions 89

List of Figures

MANUSCRIPT I

Figure 1 TPACK Framework 7

MANUSCRIPT II

Figure 1 TPACK Framework 43

MANUSCRIPT III

Figure 1 NAEYC's DAP Guidelines 83

PROLOGUE

This dissertation adheres to a journal-ready format. Three journal articles prepared for submission to refereed journals comprise the first part of the dissertation. Manuscript I, Virtual Early Childhood Education: Flying the Plane as it is Being Built, is prepared for the journal *Teaching and Teacher Education*. Manuscript II, Brick-and-Mortar to Virtual: Targeted Support is a Must, is prepared for the journal *Childhood Development*. Manuscript III, Brick-and-Mortar Teachers Go Virtual: Our World has Changed, is prepared for the journal *Young Children.*

Dissertation Abstract

Connecting pedagogical practices with content by using the various technological devices has consistently been a challenge for teachers (Chai et al., 2013; Koehler & Mishra, 2009; Mecoli, 2013). But what happens when the platform changes from brick-and-mortar to virtual? The COVID-19 Pandemic forced teachers across the globe to leave in-person learning and go virtual (Garcia & Weiss, 2020; United Nations, 2020). Considering this rapid shift in instructional presentation, early childhood education (ECE) teachers were left with many challenges. This collection of three manuscripts uses the voice of brick-and-mortar ECE teachers who pivoted to virtual instruction at a moment's notice. Through using the technological pedagogical and content knowledge framework (TPACK; Koehler et al., 2013; Mishra & Koehler, 2009) and National Association for the Education of Young Children's (NAEYC, 2020) developmentally appropriate practice (DAP) guidelines, insight is gained in the first manuscript qualitatively about what challenges ECE virtual teachers faced while implementing pedagogy, technology, and content knowledge with young students. Manuscript I also asks if the strategies used by ECE teachers are considered DAP? The second manuscript used a mixed methods to answer quantitatively how ECE virtual teachers implemented TPACK and qualitatively how did ECE virtual teachers assess student learning? The final manuscript shares directly from a PreK teacher and a 1st grade teacher, who collectively have 29 years of teaching experience and hold master's degrees, their strategies used while teaching virtually and align these strategies with NAEYC's DAP guidelines (2020).

Keywords: virtual education, early childhood education, developmentally appropriate practice, TPACK; COVID-19

MANUSCRIPT I

Virtual Early Childhood Education:

Flying the Plane as it is Being Built

This manuscript is prepared for submission to the peer-reviewed journal *Teaching and Teacher Education* and is the first of three manuscripts prepared for a journal-ready doctoral dissertation.

Abstract

Due to COVID-19 disruptions, many early childhood education (ECE) teachers were forced to deliver virtual education (Garcia & Weiss, 2020; United Nations, 2020), typically with little notice of preparation. This study asks two research questions: What challenges did ECE virtual teachers face while implementing pedagogy, technology, and content knowledge with young students? Are the strategies used by ECE teachers considered developmentally appropriate practice (DAP)? Utilizing a qualitative design to empower virtual ECE teachers the opportunity to share their stories, this study reveals the challenge to connect pedagogical practices to the content through the technological piece of virtual education (Bazeley, 2013; Miles et al., 2017).

Keywords: virtual education, early childhood education, developmentally appropriate practice, TPACK, COVID-19

Virtual Early Childhood Education: Flying the Plane as it is Being Built

Introduction

> And thankfully because the whole world was going through [virtual learning], information was coming out. And I was reading different research articles, different blogs, different resources as quickly as possible. But we were essentially building the plane as we were flying it. (Leslie)

When COVID-19 entered the world stage, the field of education was not immune from the disruption (Garcia & Weiss, 2020). Approximately 1.6 billion learners in over 190 countries were directly affected by school closings, diverted learning spaces, and alternative instructional delivery methods (United Nations, 2020). COVID-19 forced educators to abandon traditional brick-and-mortar platforms and experience the growing trend of virtual education all in a moment's notice. In the United States alone, virtual school sky-rocketed to 55 million students making it a widely used avenue for students to learn (Garcia & Weiss, 2020). The virtual platform caused many teachers to toss out their in-person lesson plans, assessment strategies, and all their community-building approaches and adapt virtually for the remaining weeks of the 2019-2020 school year and beyond.

As virtual education grows across the nation and globe, research has followed suit, especially in light of the COVID-19 virtual surge. Hidayati and Rudiyanto (2021) conclude that distance learning can occur within early childhood education (ECE) by using various media avenues and learning activities. The success or failure of distance learning though was dependent upon the planning, skill level of educators and families, and the resources available for the varying demographics within each school. "I think [virtual education] is terrific if [the students]

have engaged parents who make sure that [the students] are getting socialization and engaging with the world around them. It matters," Chloe, an ECE virtual teacher explains.

With the increase in demand for virtual education, comes new demands upon educators (Baran et al., 2011). Roles and expectations of teachers have been changing along with the education platforms. Teachers must rethink and adapt their educational culture, delivery of academics, organization, and teaching methods' while transitioning to virtual education (Howell et al., 2004). Much of professional development for virtual educators is aimed towards technology use or learning new technology. These changes have even influenced preservice teacher (PST) education to include specific technology training (Alelaimat et al., 2021; Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016). More recently, a push for emphasizing professional development focused on the organization's educational goals supporting the use of technology and defining the difference between training geared towards technology and instructional development (Espinet et al., 2020). Just as complex as the educational organizations themselves, so is the demand for professional development which supports virtual education.

ECE teachers look to the developmentally appropriate practice (DAP) position statement published by the National Association for the Education of Young Children (NAEYC, 2020) to guide their classroom practice. NAEYC published the fourth edition DAP position statement to "maximize the opportunities for each and every child to achieve their full potential" serving children birth through age 8 (2020, p. 1). The guidelines are anchored with nine principles deriving from three centralized considerations. The three centralized considerations apprise decision-making within ECE. The first core consideration is the commonalities that occur within a child's development and learning will reflect the uniqueness of the varying social and cultural

context in which the growth occurred. Second, each child's individuality is recognized and supported as valuable contribution to the learning environment. The final core consideration is the context in which the development and learning occur and recognizing this context varies socially and culturally for each child. These three centralized considerations guide NAEYC's nine principles of child development and learning which influence teachers' practice in ECE classrooms across the nation. NAEYC's DAP framework guides this study to investigate the teaching strategies used virtually by ECE teachers.

The research questions for this study are:

- What challenges did ECE virtual teachers face while implementing pedagogy, technology, and content knowledge with young students?
- Are the strategies used by ECE teachers considered developmentally appropriate practice?

Pedagogical Technological Content Connections

A consistent gap within teacher preparation is the pedagogical connection to technology (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019; Vaughan & Beers, 2017). Merely having the technology devices available for PST use and knowing how to use the devices are not the issue. Connecting the technology to the curriculum in rich meaningful ways is where teacher educators are typically lacking. But what about teachers who were trained to teach in-person and now are forced to teach virtually? How do they connect the technology to the curriculum or the curriculum to the technology? Kennedy and Archambault (2012) noted that online teaching or virtual teaching and face-to-face teaching in the traditional brick-and-mortar platform are not the same and teacher preparation cannot be the same either. Some researchers have advocated for more synchronous experiences for PSTs and additional professional development for teachers to

help combat this problem (Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016). Experiences such as creating lesson plans using technology and exploring various technology devices are some examples researchers have suggested.

In 2019 the National Education Policy Center published an executive summary on virtual schools in the United States. One of the findings stated there was a "lack of understanding of what is actually happening in virtual education" (Molnar et al., 2019, p. 5). The summary also recommended that policymakers at all levels require virtual schools to submit proper information that demonstrates the effectiveness of the education being provided. The National Education Policy Center concluded that more research was needed on successful student outcomes in virtual education. One tool which was designed to help PSTs understand and gain confidence in technology integration was the technological, pedagogical, and content knowledge (TPACK; Mishra & Koehler, 2006) framework. This framework has been used to gain insight into how teachers integrate technology (Chai et al., 2013; Kapici & Akcay, 2020; Koehler & Mishra, 2009; Mecoli, 2013), how to improve the teaching-learning environments virtually (Qasem & Viswanathappa, 2016; Salas-Rueda, 2020), and how to teach various contents virtually (Ali et al., 2020; Chai et al., 2013; Koehler & Mishra, 2009; Polly, 2014; Salas-Rueda, 2020). This framework continues to be a valuable tool to gain insight into virtual education.

TPACK Framework

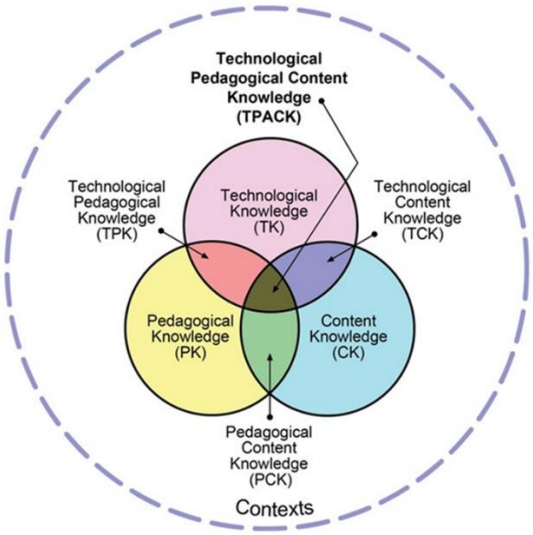
The TPACK framework (Mishra & Koehler; 2006) contributes to the overall picture of this study. Mishra and Koehler envisioned TPACK as the guide that would bring clarification and organization to blend technology between the ever-changing relationships among content, pedagogy, and technology within the classroom. Mishra and Koehler believed that enabling

teachers to see these three components separate yet together would empower them to use technology during lessons effectively.

TPACK sheds light on the challenge that has perplexed teachers for years (Chai et al., 2013; Koehler & Mishra, 2009; Mecoli, 2013): how to integrate technology appropriately to make it worthy of the students' and teachers' time. Technology-centered professional development sessions and PST courses are typically isolated from content knowledge (e.g., literacy, mathematics, or science) and pedagogical connection (Ali et al., 2020; Chai et al., 2013; Koehler & Mishra, 2009). PSTs and in-service teachers learn how a piece of technology works (e.g., a smartboard or an iPad), but they are not given guidance on how to use the technology effectively for teaching or learning. TPACK theoretically builds bridges connecting these separate areas making a cohesive plan to execute lessons successfully (Mishra & Koehler, 2006).

Figure 1

TPACK Framework



TPACK (2012). *TPACK Framework.* http://tpack.org/

The three main components rooted within the teacher's knowledge are: technology knowledge, pedagogical knowledge, and content knowledge (Koehler et al., 2013; Mishra & Koehler, 2006, 2009). Technology knowledge (TK) consists of *how* the piece(s) of technology work. Pedagogical knowledge (PK) encompasses DAP and involves *how* to teach the specific age. Content knowledge (CK) is linked to the subject-matter being taught: science, mathematics, literacy, etc. Within the framework, these components are valued individually, relationally, and collectively (see Figure 1; TPACK, 2012). Relationally between one another consists of technological content knowledge (TCK), pedagogical content knowledge (PCK), and technological pedagogical knowledge (TPK), the overlapping circles. Collectively together is technological pedagogical content knowledge (TPACK), the center of the framework. The outer dotted line within the image notes the context in the framework is set in. Within this study, the context is the COVID-19 Pandemic.

DAP Framework

DAP is a framework designed by NAEYC to provide research-based practices for children ages birth to 8 years (2020). Research-based practice includes methods that foster each child's optimal development and learning. Optimal methods include "learning experiences that promote the social and emotional development, physical development and health, cognitive development, and general learning competencies of each child served" (2020, p. 3). Since play is a common occurrence across all cultures, it can be a powerful fundamental avenue for learning to occur. Play also honors social and cultural contexts the child is influenced by and surrounded by. DAP honors the individuality of each child and supports the unique experience the child has and will have. Finally, DAP recognizes each child's social identities, whether they be defined by race, gender, language, or family composition, for example.

The principles developed by NAEYC also recognize the importance of the ECE teacher having pedagogical knowledge about each subject area the student is learning since students learn and develop across content areas. ECE teachers help the developing child when varying learning opportunities are provided which are just a little beyond the student's current mastery level. The final principle, laying a foundation for DAP, is connected to technology. When technology is used responsibly and intentionally in ECE, it can be a valuable tool that supports the child's development. Through these nine principles, ECE teachers can provide optimal learning opportunities for the developing child.

NAEYC's DAP framework (2020) also includes guidelines written for educators, which were written to concentrate on decisions made within six interconnected areas.

- Guideline one is centered around the community, which encompasses the young learner. The physical environment and relationships among peers and educators are all included in the contributing community.
- The second guideline intentionally focuses on the relationships built between educators and the families with the purpose of fostering community connections.
- Assessments is the focus of the third guideline which include formative and summative along with observations and documentation, so decisions are purposeful and strategic and help each child progress individually.
- The fourth guideline highlights the teaching practices which create rich learning experiences for each child while honoring their individualization and offering support as needed within all five domains.
- Guideline five relates to the engaging curriculum, which is designed to enrich the overall learning experience for the individual child.

- The final guideline focuses on the early childhood educator and the professionalism displayed while teaching the child and serving the family.

These six guidelines complement the *Professional Standards and Competencies for Early Childhood Educators* (National Association for the Education of Young Children, 2019) and are used within this study to achieve DAP within virtual education.

Definition of Terms

The following terms will be used in this study:

1. Brick-and-mortar: term to categorize a school that utilizes a physical structure to conduct face-to-face instruction or in-person learning (Miron & Urschel, 2012; Watson & North American Council for Online Learning, 2008)
2. Developmentally appropriate practice(s): framework designed by NAEYC to provide research-based practice for children ages birth to 8 years; abbreviated DAP (National Association for the Education of Young Children, 2020)
3. Early childhood education: childcare and educational settings for children ages birth to 8 years; abbreviated ECE (National Association for the Education of Young Children, 2020)
4. Virtual education: mode of education that uses the Internet to provide a portion or all the student's learning opportunities (National Forum on Education Statistics, 2015)

Review of Literature

Technology and virtual education have expanded to include ECE students in the classrooms and their homes (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019). Connected to this growth has been the continued conversation of how much technology use and intentionality of the technology use are appropriate for ECE children (American Academy of Pediatrics Council on Communications and Media, 2016a & 2016b; American Psychological

Association, 2019; Hawkey, 2019; National Association for the Education of Young Children, 2012).

Research has attempted to keep up with the technology surge within ECE. Cicconi (2014) used Vygotsky's social developmental theory, which includes the zone of proximal development, to support the use of technology in the ECE classroom. Cicconi concluded that instructional technology increases socialization and collaboration among early childhood classmates in math. Hsu et al. (2016) developed a learning model that connected museums outside of the school organizations directly to the classrooms, which expanded the experiences of all students and promoted student learning. Wang et al. (2009) concluded that technology could and should be used in ECE inquiry education based upon how inquiry-based learning activities have the potential for students to construct their knowledge, and using technology, this potential is amplified. Technology use has increased across all content areas including reading and writing (Sekeres & Castek, 2016), digital play, and assessment (Edwards & Bird, 2017), and has shown to be successful in 1st grade science tutoring (Hautola et al., 2018).

The awareness about the growing trend of technology and research-based practice use within the ECE field has not mirrored the escalating growth of use and devices (Pila et al., 2019). This is perplexing considering research also shows ECE teachers' technology-related knowledge can predict preferences of technology use within the ECE classroom (Tzuo et al., 2015). If the number of technological devices available for use for ECE teachers continues to increase along with the expected use of these devices, the need for best practice *with* the devices is needed and *how* to use the devices for effective instruction. Pila et al. (2019) also noted if ECE educators' attitudes towards technology was positive, their confidence to use technology was favorable. Additional research by Topolovcan et al. (2016) showed teachers' attitudes toward media and

computer self-efficacy are predictors of constructivist teaching while using technology. The more favorable the teachers' attitudes were towards media and self-confidence, the more student-centered learning occurred within the classroom.

Technology Challenges Teachers Face

Teachers face many challenges related to technology (Kelly, 2015; Koehler et al., 2013; Lim et al., 2013; Mishra & Koehler, 2009; Pila et al., 2019; Tondeur et al., 2016; Topolovcan et al., 2016; Tzuo et al., 2015; Zamir & Thomas, 2019). One such challenge is the lack of access to technology (Tondeur et al., 2016; Zamir & Thomas, 2019). Tondeur et al. (2016) explained that when teachers do not have access to the tools outside of school, their ability to practice, interact, explore, and play with technology also becomes challenging. These hurdles are being described as the *digital divide*, and as a result, teacher professional development must be sensitive to this external factor since teachers may not have access to the technology at home, and the only time they can explore and practice is while at school (Tondeur et al., 2016; Zamir & Thomas, 2019). Tondeur et al. (2016) expressed an additional challenge teachers face in professional development is that technology is constantly changing therefore professional development must change also. Consequently, challenges of infrastructure, Internet, linguistic differences, and geographical issues (rural areas in comparison to urban areas with greater Internet bandwidth) also exist.

Lim et al. (2013) noted that the inconsistency between technology trends within society and technology use within schools is partly connected to lack of technology planning, including professional development. As technology continues to advance within society, it seems that technology within schools is left behind creating ripple effects in the professional development

offered to teachers. Teachers who feel confident with technology report that there are missing professional development pieces to support successful integration within their lessons.

An additional hurdle teachers must face is knowing how to effectively connect technology to the intended lesson (Koehler et al., 2013; Mishra & Koehler, 2009). Koehler et al. (2013) drew attention to the variety of uses of technology within the classroom (email, software, handheld devices, etc.) based upon each piece of technology design and intentionality. Koehler et al. also recognized the intentionality and variety of use might not be straightforward and possibly require the teacher to rethink how to use the technology effectively within their classroom.

Teachers' final overarching challenge using technology is that the task is daunting (Koehler et al., 2013; Mishra & Koehler, 2009; Zamir & Thomas, 2019). Koehler et al. (2013) brought attention to the challenge a teacher faces acquiring a new skill set and new knowledge, especially when a time restriction is placed on an already busy schedule. Furthermore, if technology use does not align with the teacher's personal pedagogical belief, then it is unlikely to be used. Mishra and Koehler (2009) gave value to the truth that technology is ever-changing, and teachers recognize the rapid changes and see the task at hand as intimidating. Many technology pieces introduced within the classroom were not designed for education so they require teachers to rethink and restructure them so they can effectively be used. This process alone is overwhelming and challenging for many teachers. Zamir and Thomas (2019) noted that teachers are destined for bleak outcomes in education because of their lack of ability and time to learn new technology.

To gain insight and understanding about TPACK and virtual education, this study utilizes a qualitative design to give virtual ECE teachers the opportunity to share their strategies on pedagogy, technology, and content (Bazeley, 2013; Miles et al., 2017). Through hearing their

perspectives, a contribution to the ever-growing virtual education research within ECE, specifically in connection with student growth and lesson success will be made (Alelaimat et al., 2021; Chai et al., 2019; Rizk, 2020).

Methodology

Following the TPACK and DAP frameworks, this study focused on the participants' words and *how* pedagogical, technological, and content connections were made. Therefore, the open survey responses and the one-on-one interviews were the primary data sources to answer the two research questions (Bazeley, 2013). What challenges did ECE virtual teachers face while implementing pedagogy, technology, and content knowledge with young students? Are the strategies used by ECE teachers considered developmentally appropriate practice?

Participants and Setting

Purposeful sampling was used to select the 16 participants based upon two conditions: mode of teaching (virtual) and grade being taught (grades PreK – 3rd grades) (Merriam & Tisdell, 2016). Social media posts on 15 education groups were made along with emails sent out to three education organizations including virtual platforms and brick-and-mortar.

All 16 participated in one-on-one interviews. Ten of the participants taught virtual PreK through 3rd grade in a brick-and-mortar organization that had to change to virtual because of the COVID-19 Pandemic. Six of the participants taught virtual PreK through 3rd grade in a virtual organization. All interview participants received their professional education and training as brick-and-mortar educators and previously taught in brick-and-mortar settings. Consent forms were submitted before participation within the study. Pseudonyms were chosen by the participants or assigned to conceal participants' identity.

Demographic and professional information were collected at the time of participation (Bazeley, 2013). The questions connected to the participants' professional roles as educators showed 81% of participants to be trained and educated holding bachelor's or master's degrees, traditional certification, and multiple years of experiencing teaching in person prior to teaching virtually.

Table 1

Interview Participant Distribution

Category	Distribution
Gender	15 Female (94%) 1 Male (6%)
Race	1 African American (6%) 1 Asian (6%) 12 Caucasian (75%) 2 Native American/American Indian (13%)
Highest Level of Education	4 Bachelor's Degree (25%) 11 Master's Degree (69%) 1 Doctor of Philosophy (6%)
Path of Certification	3 Alternative Certification (19%) 13 Traditional Certification (81%)
Type of Certification	2 Early Childhood Certified (13%) 2 Elementary Certified (13%) 1 Early Childhood and Elementary Certified (6%) 4 Early or Elementary and Administration Certified (25%) 7 Early or Elementary and Additional Areas Certified (43%)
Location of Teaching	16 Taught Inside of the United States (100%)
Years Taught in Person	0 – Less than 1 Year 2 – 1 Year up to 3 Years 2 – 3 Years up to 6 Years 6 – 6 Years up to 10 Years

	3 – 10 Years up to 15 Years		1 – 15 Years up to 20 Years
	2 – 20 or more		
Type of School	4 Charter	1 Private	11 Public
Years Taught	2 – Less than 1 Year		8 – 1 Year up to 2 years
Virtually	3 – 2 Years up to 3 Years		1 – 4 Years up to 6 Years
	0 – 6 Years up to 8 Years		2 – 10 Years up to 14 Years

Note. This table demonstrates the depth of experience among the participants.

The settings varied within this study. All ECE teachers taught within the United States. No restrictions were placed upon participants regarding the school setting (charter, public, or private); the only criteria were that the teacher must have taught virtual for any amount of time. Zoom interviews occurred in the participants' personal homes or classrooms. Three interviews occurred in person at the participants' brick-and-mortar elementary sites within their classroom.

Data Sources and Procedures

One-on-One Interviews. A semi-structured interview format (Grbich, 2013) was used to conduct the 16 teacher interviews. Interviews varied from 15 minutes to 40 minutes, due to participants not being limited by response time or direction. The ECE teachers were asked about their perception of pedagogical, technology, content, and DAP (see Appendix A). Questions for the interview were formulated based upon "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009a). This published survey was created and revised because of multiple attempts to measure PSTs' TPACK and connected areas of knowledge through their own perception and self-assessment (Schmidt et al., 2009b, 2009c, 2009d; Shin et al., 2009). With an internal consistency .93 for TPK, the researcher was confident

in using this measure. The TPK questions highlighting this dynamic of the TPACK framework were used within the interviews. Permission to use the survey was granted by the creators.

Field Notebook. Field notes were used to review and document the researcher's thoughts and analysis throughout the research (Bazeley, 2013). The researcher wrote prior to each interview to organize needed information and document responses and demographic information afterward. Throughout the review of literature process, reflections and connections were documented within the field notebook. The right side of the notebook was left blank as the researcher has continued to reflect on the written notes and analyze the information.

Data Analysis. The researcher uploaded all interview audio recordings to Otter.ia for transcription, compared the typed transcription with each interview's audio recording, and made corrections as needed. Transcripts were sent individually to each participant for member checking (Bazeley, 2013). After participant approval, transcripts were uploaded to Dedoose to be analyzed. During the first cycle coding, in vivo and structural codes were used to identify and categorize the participants' responses for teaching strategies, curriculum, assessment, and environment for virtual education, professional development, and research for the 6th principle of DAP (Miles et al., 2017; National Association for the Education of Young Children, 2020). The categories of teaching strategies, curriculum, and assessment came from the four areas within the survey. Second cycle coding included a priori codes from NAEYC's (2020) DAP framework depending upon the category. The 6th principle of the DAP framework was not connected with the aforementioned, so first cycle coding included environment for virtual education, professional development, and research. Pattern coding was used to group all the summaries together.

Trustworthiness. Establishing validity and reliability are the cornerstones of ethical qualitative research (Merriam & Tisdell, 2016). The researcher ensured all procedures were approved through the university's Institutional Review Board. To increase credibility, an audit trail was kept of data collecting and various strategies used to analyze the data and utilized member checking (Bazeley, 2013). Triangulation was used by checking the findings through the literature, interviews, reflections journal, and field notebook. By utilizing these methods, multiple perspectives were gained. Bias was addressed within the field notes. The researcher also participated in debriefing meetings weekly with her professor and colleagues to remain up to date on progress and procedures being followed. Descriptions of the interviews, open ended responses, and key findings were deliberated.

Limitations. The timing of this study is a limitation. The 10 brick-and-mortar interview participants are within public school organizations and were hired to facilitate in-person instruction. Due to the COVID-19 Pandemic, these participants had to pivot to virtual learning in some capacity. This is seen as a limitation since these participants did not intentionally seek to facilitate virtual learning and research shows in-person teaching is not the same as online instruction or virtual learning (Kennedy & Archambault, 2012; Keaton & Gilbert, 2020).

Findings and Discussion

The participants differed in a broad range of titles, education, and experience within the field of ECE. By interviewing teachers from brick-and-mortar and virtual organizations, emerging themes arose answering the two research questions: What challenges did ECE virtual teachers face while implementing pedagogy, technology, and content knowledge with young students? Are the strategies used by ECE teachers considered developmentally appropriate practice? The following sections are organized by emerging themes teachers recognized as

challenges that were out of their control as they implemented pedagogy, technology, and content while teaching virtually: engagement, environment, parents' role, and assessment.

Engagement

> And then I would also look, again, my strategy is just kind of Google stuff, look through stuff, see what pops up and then go from there as to adding different links that go along with science or some math songs or something, you know, anything that can try to get them more engaged with the material, since they're so little, you know. They're not going to just sit and listen to the talk online, we needed anything that has a lot of good visual and songs. (Amanda)

Getting students engaged seemed to be a common challenging thread expressed by all participants. Transferring the brick-and-mortar curriculum or teaching methods to the virtual platform is not successful (Ford et al., 2021; Kennedy & Archambault, 2012); connecting technology with the pedagogy has been perplexing educators for years (Koehler et al., 2013). "How to get [students] to be there, like, engage, like, yes, there was engaging things, but like, I couldn't always get them involved," Marten expressed.

But engagement is not a one-way street. Teachers voiced the difficulty engaging with students on their end:

> It's really not the education. It's not the curriculum. It's not that. It's just building relationships with people and helping them become better versions of themselves is what I really like. You can do that in virtual, but it is way more difficult because you don't have the ability to see them as often to help them or personally engage with them on that personal level one on one like you do in a brick-and-mortar setting. (Suzanne)

Teachers expressed that knowing how to use the various technology pieces was not enough. They were lacking the ability to engage the students and encourage connection among each other *through* the technology. Many teachers attributed this lack of connectivity with the environment supported or not supported because of being virtual. Student engagement is a vital piece within NAEYC's (2020) DAP framework. For the child's optimal development to occur, the student must participate in engaged learning: interacting with the materials, having conversations with the teacher(s), having social interactions among peers, making autonomous choices in play and free exploration. The ECE teachers recognized the value of student engagement and recognized the absence of student engagement.

The virtual teachers described how they do receive training rooted in technology and pedagogy. Being trained on *how* to use the available computer software was one capacity of the professional development virtual teachers received. In addition, they also participated in trainings with other virtual teachers on applying the software to the specific subjects they taught along with the grade level. This training also included collaborating with colleagues and brainstorming on successful tactics and ideas on overcoming challenges experienced, especially low student engagement. However, the brick-and-mortar teachers voiced a deep need for the pedagogical connection to technology, which continues to support previous research saying stronger curriculum connections in PST programs focusing on technology and pedagogical need to exist (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019). Recent research is also supporting a focus for professional development to support the use of technology and define the difference between training geared towards technology and instructional development (Espinet et al., 2020). This study reflects the continued need for the pedagogical connection to technology

within professional development and within PST education (Alelaimat et al., 2021; Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016).

Environment

"You know, there's also the aspect of what environment [students] are in, because being at home with your cats and your dogs, and your baby brother and baby sister, is a much different environment than being in your kindergarten classroom" Marissa explained. As the participants were asked about virtual education, descriptions of the learning environment emerged as a consistent topic. Participants voiced concerns about equity, not only within the tangible items that make virtual learning possible (tablet, computer, WiFi for example), but the physical learning environment that can support a community of learning.

> So, there's a lot of, you know, pre-setting that scene that the environment with the adult that's overseeing it, as much as there is to teach that lesson. I think sometimes there's almost more involved in pre-setting that environment with the adult to make that learning environment conducive to virtual learner. Because if there's, you know, baby sister sitting within arm's reach, and the baby's crying and adults running all over, the child's not going to want to engage as much with what [the teacher] is doing a lot of times. I've been teaching for a long time; I call it with-it-ness. There's a with-it-ness when you're sitting in a classroom in brick-and-mortar, and that's just being aware of your surroundings, being aware of what kind of questions kids are asked, being aware of what kind of situations could occur and preventing them and creating enough structure where you don't have that. There's that same piece to virtual teaching with young children is that the with-it-ness is how are you setting that environment? What tools are you going to use with that child? (Bridgette)

The participants' viewpoints support Hidayati and Rudiyanto's conclusion (2021) that the powerful connection of the families' abilities to plan and provide resources to virtual learners set the stage for success or failure. Getting an area in the home ready for live sessions with the teacher, having materials ready, and helping minimize background noise and distractions were just a few ways parents could help set the stage for the virtual learning outcome. Ford et al. (2021) surveyed 1,434 ECE teachers across the country and concluded that parents' engagement is vital to the ECE virtual learner outcome. Within this study, participants expressed how the environment established by the students' families greatly influenced the engagement of the student both in a positive and negative way. Helping parents become aware of this powerful role and giving them insight into how to create the optimal learning environment exactly helps the virtual student experience success.

> The best tools [for virtual education to be successful] would be good WiFi. Also, having the parent be educated on what's a good learning environment for their student. Not to be sitting in bed, having them at a desk without distractions, and not a lot of background noise, just a good setup in general. (Marten)

The participants' statements align with Kennedy and Archambault's (2012) findings that there is a clear distinction between virtual teaching and in-person teaching. Teachers explained they lacked control to create a specific learning environment that invites a community of learning. Within a brick-and-mortar setting, the teachers can set up the classroom to surround the child with learning materials such as age-appropriate manipulatives, furniture, and art supplies. Teachers can also limit the number of distractions and interruptions by controlling the environment. The teachers' viewpoints express the importance of the environment. NAEYC's (2020) DAP framework emphasizes the educator's role in "creating a rich, play-based learning

environment that encourages the development of knowledge and skills across all domains," (2020, p. 11). Within DAP, the environment utilizes the student's native language, helps develop social identity, provides activities which foster subject area knowledge for all areas, including the developmental domains (language, physical, social, emotional, and cognitive), is stimulating yet is not over-stimulating for the child, is intentionally designed, and predictable. In virtual education, the teachers recognized that their ability to ensure a DAP environment occurs is not in their control and is very challenging to ensure that it takes place.

Parents' Role

"You just have to be in tune and listen to the parents, because the parents know their kiddos, way better than we do" (Tricia). All participants recognized how parents play a vital role in virtual education. Whether it was establishing the learning environment, providing specific materials to execute a lesson, getting the student on a Zoom session at the exact time needed, the parents have the potential to deepen and enrich the virtual learning experience. "I would tell the parents in advance, like if they needed counters, whether it be cereal or whatever, I would let them know in advance what to prepare for that activity that I was going to do at that time," Maria explained. Even as parents gained a front-row seat in their child's education, some teachers reflected and believed an opportunity was missed in educating parents on why things are done in ECE.

> I think [parents] also need a lot of information about the why behind things and what they can specifically do to help their child develop. I think we were able to get parents to get [their children] on a device, which was fine. However, what if we would have said, 'Let me explain to you when you when you put a puzzle together, this is what that actually does.' Or 'When you let your child go play either outside of their own backyard or you

> go to your neighborhood park, and you don't intervene and you let them essentially just negotiate the rules on the playground, this is the why that's so important for them.' And a lot of our parents just don't know the why. And I think we missed an opportunity to educate them. But I don't think none of us were in a position to do that either. Because it was very stressful. (Carrie)

Pivoting from brick-and-mortar, teachers noticed how important communication with parents truly was (Haiyudi & Art-in, 2021). Watching the clock to know the exact time a kindergartner needs to log on to their school-issued device to meet their teacher for a virtual meeting, to staying on task for the required lesson were just two examples teachers relied on parents to do during virtual education. Along with Hidayati and Rudiyanto (2021), teachers in this study realized that families play an intricate role in the success or failure of virtual learning in ECE. Additional research conducted by Ford et al. (2021) supports the imperative partnership between teachers and parents throughout virtual education. In addition to communication and staying on task, engagement or participation given from parents to teachers was also key to success: parents asking for clarification, responding to messages, and overall being involved in the virtual experience. Teachers recognized how parents were busy and overwhelmed. However, teachers were troubled with the low level of parental engagement. When the teachers received no communication back from the parents after they left messages or if the student consistently missed live class sessions, they felt discouraged and worried about the students' academic growth. Teachers felt that when a student was available and ready for virtual learning, it was because an engaged parent prepared them.

The ECE teachers' view of parents and the role parents play in virtual education align with NAEYC's (2020) DAP view of the role of the family: pivotal and vital. NAEYC

encourages ECE teachers to value family language, honor each family's unique makeup and dynamics, seek information from the family to individualize the student's learning journey, build consistent relationships with the student's family while "drawing upon the strengths and resources each child and family brings" (2020, p. 12). Making each of these possible through virtual education was a challenge for the teachers. They acknowledged the vital role the parents play but empowering the parent and engaging the parent within these capacities was difficult. Teachers increased communication after contract hours to engage parents via additional phone calls, text messages through parent communication apps and personal cell phones, and email. Teachers also used their evenings and weekends to respond to parental communication.

Assessment

Assessment was a struggle for brick-and-mortar teachers, especially in the younger grades like PreK and kindergarten:

> Now, there was a couple of Teaching Strategies, Gold had a [checklist] where I could send to parents, and they would help collect some of the data that I was not able to see. So, like all those social emotional objectives, whether interacting with peers and stuff, I couldn't assess that, because I wasn't there. (Stacy)

Teachers were challenged to assess each child's development and learning through a screen and turned to parents for help:

> [Measuring student's success] was tricky. I would send questionnaires home a couple times a year. That was just like, 'Okay, parents, what do you see that your kids know?' So really because it was virtual, I couldn't gauge where the kids were at. It really had to be on the in-person for the age I was teaching to be able to really see anything that I

could say, 'Yeah, I feel comfortable saying that I know this kid knows how to do this.' (Shannon)

Looking to the parents to send pictures of the student's work was one way Stacy and Shannon (and other teachers) were able to assess their students. They recognized certain learning objectives were not possible to assess through a live session. They needed the student in a different atmosphere like interacting with cousins or climbing up a ladder to go down a big slide. By involving the parents with this type of data collection, teachers were able to broaden their view beyond a live Zoom call with the students and gain insight into the students' ability in other settings. Other teachers across the globe used this assessment tactic during this pandemic time (Haiyudi & Art-In, 2021). Intensive communication between teachers and parents was key to conducting assessments and using assessments appropriately.

Many of the brick-and-mortar teachers across all grades explained how they had to decrease their group sizes to accommodate assessment, the virtual teachers explained this was their trick to assessment also: small groups and one-on-one. Teachers continued to rely heavily on anecdotal notes, student artifacts, and conversations through Zoom meetings for assessment. This change in gathering student work was not only a challenge in getting it done, but it was also connected to the bigger challenge of feeling successful as a teacher and continuing to stay motivated.

> The success wasn't equal [in virtual learning] to what success was in the classroom, it just wasn't in my experience. So that was hard. The same amount year after year, the kind of data you get. I know certain kids are going to move certain levels and we're going to see this kind of growth. But that just wasn't occurring. It was difficult to stay motivated. But it's difficult to not get down on yourself. Because you knew, even though it might or may

not be your fault, you knew you weren't getting the progress that needs to be done. (Marten)

The brick-and-mortar teachers struggled with changing not only their assessment methods but also changing their expectations for success. Teachers knew what growth to expect for their students who participated in a 9-month in-person learning for 8 consecutive hours daily. They did not know the learning trajectory of students who participated in segregated live sessions for the morning, coming back together later in the morning, joining back together in a small group setting in the afternoon while students worked on many things independently, some with parental support and some without. This change in knowing what to expect from students weighed heavily on teachers; they struggled with having a clear understanding of how to measure learning.

> When [the students] are creating, there's different ways [to measure student success]. Student success could be in a lesson you read, and you're watching them, and they're engaged. You know, their eye contact is on you. They're engaging with the story. They're asking questions. They're answering questions. They're fully engaged with littles. You may not have that, 'Oh, they took a test and they did well on it.' They are five and they're not taking tests on a regular basis. In general, it is that informative, body language engagement, questions, and smiling. That's where you're seeing the progress and their achievement. (Jasmine)

The challenge with assessment and defining student success in virtual education is connected to technology pedagogy, which has been difficult for teachers and could have been helped or alleviated with targeted professional development or specialized PST education (Koehler et al., 2013). Transferring in-person assessments to a virtual platform does not work. Teachers had to

conduct assessments through a screen with many factors out of their control: background noise, showing the exact manipulative needed for the assessment, and physically witnessing the student completing the necessary task. Despite these challenges, the change in assessments was an example of how ECE virtual teachers implemented pedagogy, technology, and content knowledge with their young students. They decreased group sizes, changed the assessment methods, sought out parental help, and re-evaluated their expectations for students.

Conclusion

> We really should have been much more cognizant of screen time. And I think the language delays that we inadvertently created by actually muting kids and by not allowing kids to converse, by not setting up playdates where kids can talk back and forth to one another on the screen was detrimental. And that we were kind of forced into telling five- and six-year-olds, you need to be on this screen for this long period of time. (Sheila)

Upon reflection, Sheila could see how navigating virtual education with minimal support and training left teachers and students with consequences still being felt today. As COVID-19 pushed virtual education on families, students, and educators, challenges were experienced. Teachers shared how they implemented pedagogy, technology, and content knowledge through the virtual platform and the challenges that arose.

The DAP framework was written encompassing *all* childcare settings (NAEYC, 2020). As a result of COVID-19, virtual education is a common mode of teaching in ECE (Garcia & Weiss, 2020). Additional explanation and examples for each DAP guideline that are virtual education-focused would benefit all stakeholders, including PST programs, ECE teachers, and families. By collaborating with ECE virtual teachers who come from a brick-and-mortar organization and from a virtual organization, teachers can explain what components of DAP are

missing from virtual learning (setting up a DAP virtual environment), how adaption occurred (various assessments and student engagement), or which components are extremely challenging to transfer over (defining the parents' role in virtual education).

A second implication from this study is the importance of the environment. Within the virtual learning experience for ECE students, the parents, grandparents, and caregivers control the surrounding noise level, minimize distractions, ensure sufficient Internet capability is present, and help the student log on at the correct time. Providing the families and caregivers with information about the importance and magnitude of these aforementioned environmental components would help ensure an optimal learning environment is provided. In addition, parental communication and collaboration between teachers and families can strengthen the virtual learning experience for ECE students (Hidayati & Rudiyanto, 2020).

This study sought out the personal experiences from ECE teachers who had to pivot from brick-and-mortar to virtual teaching in response to a pandemic. The emerging themes noted that going from in-person instruction to a screen was not seamless or easy. Rather, many adaptations occurred, including how to pedagogically apply the greater use of technology to make it user-friendly for ECE students. Revelations of more professional development and PST specialized training on how to make technology connected to ECE are needed. By addressing these, steps and plans to transition from brick and mortar to virtual learning can be written, implemented, and assessed. Since research has shown in-person teaching is quite different from virtual teaching (Kennedy & Archambault, 2012), targeted training and professional development can better equip future teachers and current teachers. "We figured out how to teach virtually through trial error. Just trying to figure it out, and we were all kind of building the plane as we were flying on it. None of us really knew what we were doing" (Candace).

References

Alelaimat, A. M., Ihmeideh, F. M., & Alkhawaldeh, M. F. (2021). Preparing preservice teachers for teachers for technology and digital media integration: Implications for early childhood teacher education programs. *International Journal of Early Childhood, 52,* 299-317. https://doi.org/10.1007/s13158-020-00276-2

Ali, Z., Thomas, M., & Hamid, S. (2020). Teacher educators' perception of technological and content knowledge on their classroom teaching. *New Horizons, 14*(2), 17-38. https://doi.org/10.2.9270/NH.14.2(20).02

American Academy of Pediatrics Council on Communications and Media. (2016). Media and young minds. *Pediatrics, 138*(5). https://doi.org/10.1542/peds.2015-2591

American Academy of Pediatrics Council on Communications and Media. (2016). Media use in school-aged children and adolescents. *Pediatrics, 138*(5). https://doi.org/10.1542/peds.2016-2592

American Psychological Association. (2019, December 12). Digital guidelines: Promoting healthy technology use for children. CYF News. https://www.apa.org/topics/social-media-internet/technology-use-children

Baran, E., Correia, A., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education, 32*(3), 421-439. http://dx.doi.org/10.1080/01587919.2011.610293

Bazeley, P. (2013). *Qualitative data analysis: Practical strategies.* Sage Publications, Inc.

Chai, C. S., Jong, M., Yin, H., Chen, M., & Zhou, W. (2019). Validating and modeling teachers' technological pedagogical content knowledge for integrative science, technology, engineering and mathemat-ics education. *Journal of Educational Technology & Society, 22*(3), 61-73. https://www.jsotr.org/stable/10.2307.26896710

Chai, C. S., Koh, J. H. L., & Tsai, C. (2013). A review of technological pedagogical content knowledge. *Journal of Educational Technology & Society, 16*(2), 31-51. https://www.jstor.org/stable/10.2307/jeductechsoci.16.2.31

Cicconi, M. (2014). Vygotsky meets technology: A reinvention of collaboration in the early childhood mathematics classroom. *Early Childhood Education Journal, 42*, 27-65. https://doi.org/10.1007/s10643-013-0582-9

Czerkawski, B. C. (2014). Designing deeper learning experiences for online instruction. *Journal of Interactive Online Learning, 13*(2), 29-40. http://www.ncolr.org/jiol

Edwards, S. & Bird, J. (2017). Observing and assessing young children's digital play in the early

years: Using the digital play framework. *Journal of Early Childhood Research, 15*(2), 158-173. https://doi.org.10.1177/1476718X15579746

Espinet, T., Vuong, P. M., & Filback, R. A. (2020). Beyond onboarding: Building a culture of continuous professional development for effective online instruction. In Inoue-Smith, Y., & McVey, T. (Ed.), *Optimizing higher education learning through activities and assessments* (pp. 97-114). IGI Global. https://doi.org/10.4018/978-1-7998-4036-7.ch006

Ford, T. G., Kwon, K-A., & Tsotsoros, J. D. (2021). Early childhood distance learning in the U.S. during the COVID pandemic: Challenges and opportunities. *Children and Youth Services Review, 131*. https://doi.org/10.1016/j.childyouth.2021.106297

Garcia, E., & Weiss, E. (2020). *Covid-19 and student performance, equity, and U.S. education policy: Lessons from pre-pandemic research to inform relief, recovery, and rebuilding.* Economic Policy Institute. https://www.epi.org/ publication/the-consequences-of-the-covid-19-pandemic-for-education-performance-and-equity-in-the-united-states-what-can-we-learn-from-pre-pandemic-research-to-inform-relief-recovery-and-rebuilding/

Grbich, C. (2013). *Qualitative data analysis: An introduction* (2nd ed.). Sage Publications.

Haiyudi, H., & Art-In, S. (2021). Parents' involvement in learning assessment during remote learning in pandemic era. *Jurnal Kajian Teknologi Pendidikan, 4*(1), 108-118. https://doi.org/10.17977/um038v4i12021p108

Hautola, J., Baker, D. L., Keurulainen, A., Ronimus, M., Richardson, U., & Cole, R. (2018). Early science learning with a virtual tutor through multimedia explanations and feedback on spoken questions. *Education Tech Research Development, 66*, 403-428. https.//doi.org/10.1007/s11423-017-9558-6

Hawkey, E. (2019). Media use in childhood: Evidence-based recommendations for caregivers. CYF News. https://www.apa.org/pi/families/resources/newsletter/2019/05/media-use-childhood

Hidayati, N., & Rudiyanto. (2021). Distance Learning in Early Childhood Education During Pandemic COVID-19. Proceedings of the 5th International Conference on Early Childhood Education (ICECE 2020). https://doi.org/10.2991/assehr.k.210322.045

Howell, S. L., Saba, F., Lindsay, N. K., & Williams, P. B. (2004). Seven strategies for enabling faculty success in distance education. *The Internet and Higher Education, 7*(1), 33-49. https://doi.org/10.1016/j.iheduc.2003.11.005

Hsu, T., Kuo, F., Liang, H., & Lee, M. (2016). A curriculum-based virtual and physical mobile learning model for elementary schools in museums. *The Electronic Library, 34*(6), 997-1012. https://doi.org/10.118?EL-08-2015-0146

Kapici, H. O., & Akcay, H. (2020). Improving student teachers' TPACK self-efficacy through lesson planning practice in the virtual platform. *Educational Studies.* https://doi.org/10.1080/03055698.2020.1835610

Keaton, W., & Gilbert, A. (2020). Successful online learning: What does learner interaction with peers, instructors and parent look like? *Journal of Online Learning Research, 6*(2), 129-154.

Kelly, D. P. (2015). Overcoming barriers to classroom technology integration. *Educational Technology, 55*(2), 40-43. https://www.jstor.org/stable/44430356

Kennedy, K., & Archambault, L. (2012). Offering preservice teachers field experiences in K-12 online learning: A national survey of teacher education programs. *Journal of Teacher Education, 63*(3), 185-200. https://doi.org/10.1177/0022487111433651

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *The Journal of Education, 193*(3), 13-19. https://doi.org/10.1177/002205741319300303

Lim, C. P., Zhao, Y., Tondeur, J., Chai, C. S., & Tsai, C. (2013). Bridging the gap: Technology trends and use of technology in schools. *Journal of Educational Technology & Society, 16*(2), 59-68. https://www.jstor.org/stable/10.2307/jeductechsoci.16.2.59

Mecoli, S. (2013). The influence of the pedagogical content knowledge theoretical framework on research on preservice teacher education. *The Journal of Education, 193*(3), 21-27. https://doi.org/10.1177/002205741319300304

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

Miles, M. B., Huberman, A. M., & Saldana, J. (2017). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Sage Publications, Inc.

Miron, G., & Urschel, J. L. (2012). *Understanding and Improving Full-time Virtual Schools: A Study of Student Characteristics, School Finance, and School Performance in Schools Operated by K12 Inc.* National Education Policy Center. http://neps.colorado.edu/publication/understanding-improving-virtual.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 10-17. https://doi.org/10.1111/J.1467-9620.2006.00684.X

Mishra, P., & Koehler, M. (2009). Too cool for school? No way! Using the TPACK framework: You can have your hot tools and teach with them, too. *Learning & Leading with Technology, 36*(7), 14-18.

Molnar, A., Miron, G., Elgeberi, N., Barbour, M. K., Huerta, L., Shafer, S. R., Rice, J. K., & National Education Policy Center. (2019). *Virtual Schools in the U.S. 2019.* School of Education. http://nepc.colorado.edu/sites/default/files/publications/Virtual%20Schools%202019.pdf

National Association for the Education of Young Children. (2012). Position Statement on Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8. https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/topics/PS_technology_WEB.pdf

National Association for the Education of Young Children. (2019). Position Statement on Professional Standards and Competencies for Early Childhood Educators. https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/position-statements/standards_and_competencies_ps.pdf

National Association for the Education of Young Children. (2020). Position Statement on Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8 (4th ed.). https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/position-statements/dap-statement_0.pdf

National Forum on Education Statistics. (2015). *Forum guide to elementary/secondary virtual education data.* U.S. Department of Education. National Center for Education Statistics. https://nces.ed.gov/pubs2016/NFES2016095.pdf

Pila, S., Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2019). *Technology in the lives of educators and early childhood programs: 2018 Survey.* Center on Media and Human Development, Northwestern University. https://cmhd.northwestern.edu/wp-content/uploads/2019/08/NAEYC-Report-2019.pdf

Polly, D. (2014). Deepening pre-service teachers' knowledge of technology, pedagogy, and content (TPACK) in an elementary school mathematics methods course. *Journal of Computers in Mathematics and Science Teaching, 33*(2), 233-250. https://www.learntechlib.org/p/43272

Qasem, A. A. A., & Viswanathappa, G. (2016). Blended learning approach to develop the teachers' TPACK. *Contemporary Educational Technology, 7*(3), 264-276. https://dergipark.org.tr/en/pub/cet/issue/25745/271562

Rizk, J. (2020). Considerations for implementing emerging technologies and innovative pedagogies in twenty-first-century classrooms. In S. Yu, M. Ally, & A. Tsinakos (Eds.), *Emerging technologies and pedagogies in the curriculum* (pp. 447-460). Springer.

https://doi.org/10.1007/978-981-15-0618-5_26

Salas-Rueda, R. A. (2020). TPACK: Technological, pedagogical and content model necessary to imporve the educational process on mathematics through a web application. *International Electronic Journal of Mathematics Education, 15*(1), 1-13. https://doi.og/10.29333/iejme/5887

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education, 42*(2), 123-149. https://doi.org/10.1080/15391523.2009.10782544

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). The continuing development, validation and implementation of a TPACK assessment instrument for preservice teachers. In *Proceedings of the 2010 Annual Meeting of the American Educational Research Association, Denver, CO*.

Schmidt, D., Baran, E., Thompson, A., Koehler, M., Punya, M., & Shin, T. (2009). Examining Preservice Teachers' Development of Technological Pedagogical Content Knowledge in An Introductory Instructional Technology Course. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen & D. Willis (Eds.), *Proceedings of SITE 2009-Society for Information Technology & Teacher Education International Conference* (pp. 4145-4151). Charleston, SC, USA: Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/31308/

Sekeres, D. C. & Castek, J. (2016). Collaborative online inquiry: Exploring students' skills in locating, reading, and communicating information. *Journal of Interactive Online Learning, 14*(2), 58-79. http://www.ncolr.org/issues/jiol/v14/n2/2

Shin, T., Koehler, M., Mishra, P., Schmidt, D., Baran, E., & Thompson, A. (2009). Changing Technological Pedagogical Content Knowledge (TPACK) through Course Experiences. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen, & D. Willis (Eds.), *Proceedings of SITE 2009-Society for Information Technology & Teacher Education International Conference* (pp. 4152-4159). Charleston, SC, USA: Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/31309/

TPACK (2012). *TPACK Framework.* http://tpack.org/

Tondeur, J., Forkosh-Baruch, A., Prestridge, S., Albion, P., & Edirisinghe, S. (2016). Responding to challenges in teacher professional development for ICT integration in

education. *Journal of Educational Technology & Society, 19*(3), 110-120. https://www.jstor.org/stable/10.2307/jeductechsoci.19.3.110

Topolovacan. T., Matjevic, M., & Dumancic, M. (2016). Some predictors of constructivist teaching in elementary education. *Croatian Journal of Education, 18*(1), 193-212. https://doi.org.10.15516/cje.v18i9.2217

Tzuo, P., Toh, L. P. E., & Liang, J. (2015). Early childhood teachers' views towards using constructivist internet-based environments to support children's learning activities: A mixed-methods study. *Australasian Journal of Early Childhood, 40*(1), 81-90. https://doi.org/10.1177/183693911504000111

United Nations. (2020). Education during COVID-19 and beyond. https://www.un.org/ development/desa/dspd/wp-content/uploads/sites/22/2020/08 /sg_policy_brief_covid-19_and_education_ august_ 2020.pdf

Vaughan, M., & Beers, C. (2017). Using an exploratory professional development initiative to introduce iPads in the early childhood education classroom. *Early Childhood Education Journal, 43*, 321-331. https://doi.org.10.1007/s1064301607723

Wang, F., Kinzie, M. B., McGuire, P., & Pan, E. (2009). Applying technology to inquiry-based learning in early childhood education. *Early Childhood Education, 37*, 381-389. https://doi.org/10.1007/s10643-009-0364-6

Watson, J., & North American Council for Online Learning. (2008). Blended learning: The convergence of online and face-to-face education. *Promising Practices in Online Learning.* https://files.eric.ed.gov/fulltext/ED509636.pdf

Zamir, S., & Thomas, M. (2019). Effects of university teachers' perceptions, attitudes and motivation on their readiness for the integration of ICT in classroom teaching. *Journal of Education and Educational Development, 6*(2), 308-326. https://doi.org/10.22555/joeed.v6i2.2712

Appendix A

ECE Virtual Teacher Interview Questions

Interview questions: *Participants have already completed the survey*

1. Tell me about some of the effective teaching strategies you use to guide student thinking and learning in your classroom.

2. How do you select these teaching strategies?

3. How do you choose the content to teach?

4. What curriculum do you have?

5. Tell me how these strategies are supported by the technology you use.

6. What other technologies do you use to enhance your lessons? How did you find these technologies?

7. Tell me about any professional development that has helped you?

8. How did you receive this professional development?

9. Was the professional development something you sought on your own or was it offered to you?

10. How do you measure student success in virtual education?

11. What are the tools teachers need to be successful in virtual education?

12. Are you using specific apps for individualization?

13. Talk about the process and how it helped you or not helped you.

14. Are you supporting other virtual teachers or mentoring them? What are some ways you are doing this?

15. This whole process (being trained as a brick-and-mortar educator and pivoting to virtual teaching) how has it helped you professionally?

16. Is there anything else you would like to add regarding virtual teaching within early childhood education?

[1]Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

MANUSCRIPT II

Brick-and-Mortar to Virtual: Targeted Support is a Must

This manuscript is prepared for submission to the peer-reviewed journal *Child Development* and is the second of three manuscripts prepared for a journal-ready doctoral dissertation.

Abstract

Early childhood education (ECE) was not excluded from being affected by COVID-19 (Garcia & Weiss, 2020; United Nations, 2020). Traditionally, ECE occurs with in-person instruction nestled in a brick-and-mortar setting where teachers and students freely interact, venture to the playground together, and transition from art to center time to music to lunch. As a result of COVID-19, ECE teachers had to leave brick-and-mortar and go to virtual education. This study asks two research questions: Do virtual teachers display confidence while implementing pedagogy, technology, and content with ECE virtual students? How do virtual teachers assess student learning? By using the technological, pedagogical, and content knowledge (TPACK) framework, this mixed-design study surveyed 99 ECE educators and interviewed 25 of the survey participants (Mishra & Koehler; 2006). Results showed teachers perceived their confidence to implement pedagogy, technology, and content the highest with technological pedagogical knowledge (TPK). Through open-ended survey responses and interviews, teachers voiced that professional development is needed, specifically connected to pedagogy. Teachers explained how they used summative and formative assessments to assess student learning, and engagement was a consistent standard for teachers. Finally, teachers voiced how having more conversations with parents about their roles in virtual education would have been beneficial, especially with assessment. This study contributes to ECE virtual education research (Alelaimat et al., 2021; Chai et al., 2019; Rizk, 2020).

Keywords: TPACK, early childhood education, virtual learning, assessment, COVID-19

Brick-and-Mortar to Virtual: Targeted Support is a Must

Introduction

The year 2020 brought havoc to the education world through the COVID-19 Pandemic. In over 190 countries, approximately 1.6 billion learners experienced school closings, altered learning spaces, and various instructional delivery methods (United Nations, 2020). COVID-19 required educators to change their traditional brick-and-mortar delivery approaches and experience virtual education (Garcia & Weiss, 2020). Early childhood education (ECE) teachers specifically faced the challenge of pivoting from a hands-on experience-based physical classroom to a virtual classroom through a computer screen (Atiles et al., 2021). The issue at hand is COVID-19 sped up the amount of technology use in ECE specifically through the virtual learning platform which was on track to be an accepted mode of education (Kennedy & Archambault, 2012; Palvia et al., 2018). Were ECE teachers ready to move their brick-and-mortar teaching strategies to virtual education?

Technological pedagogical content knowledge (TPACK) is a teacher framework that guides the teacher in theory and practice (Koehler et al., 2013). By content, pedagogy, and technology interacting with one another and all together, flexible knowledge is produced for the teacher to successfully blend technology into teaching. Having technology present in the classroom does not make it prone to be used with an educational purpose (Mishra & Koehler, 2009). However, technology does hold the possibility of changing educators' perceptions about lesson execution, changing the presentation, or even the entire lesson format. Many technological devices and software used in education were not designed for classroom use (Koehler et al., 2013). Therefore, educators had to learn to repurpose and adapt technology to

meet their educational needs. TPACK helps make this repurposing and adaptations possible (Mishra & Koehler, 2009).

Even when the platform changes for instruction, one constant remains the same: what optimal developmentally appropriate practice (DAP) should be used for students? National Association for the Education of Young Children (NAEYC, 2020) published guidelines for DAP in a position statement to set a high standard of serving children birth through age 8. One of the DAP guidelines focuses on assessment. Guideline 3 states: "Observing, documenting, and assessing each child's development and learning are essential processes for educators and programs to plan, implement, and evaluate the effectiveness of the experiences they provide to children" (2020, p. 19). In addition, utilizing valid and reliable methods of assessment guides the teacher in providing support, scaffolding, and in specific instances additional help for students in need.

The two research questions for this study are:

- Do virtual teachers display confidence while implementing pedagogy, technology, and content with ECE virtual students?
- How do virtual teachers assess student learning?

Virtual Education Gaps

Over the years, as technology use has increased in ECE, teacher preparation programs have tried to keep up, especially with connecting pedagogy to technology (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019; Vaughan & Beers, 2017). Teachers have voiced the struggle of making this connection within their classroom over the years. This struggle deepens when the trained and educated brick-and-mortar teacher must rapidly change to the virtual platform. Research has recognized virtual teaching is quite different from in-person instruction (Kennedy

& Archambault, 2012; Kim, 2020). Many researchers have suggested changing preservice teacher (PST) education programs to include virtual teaching opportunities, so PSTs can gain experience in virtual teaching (Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016).

Another complex dynamic of virtual education is a "lack of understanding of what is happening in virtual education" (Molnar et al., 2019, p. 5). The National Education Policy Center issued an executive summary about virtual education within the United States. One of the conclusions was a murky perception of the workings of virtual education, including assessment. A recommendation to clarify these confusions was for policymakers at local, state, and federal levels to mandate virtual schools submit proof that effective education is being provided for their students. The summary also called for additional research highlighting student outcomes in virtual education due to assessments. This study addresses these two gaps within virtual education.

Theoretical Framework

TPACK Framework

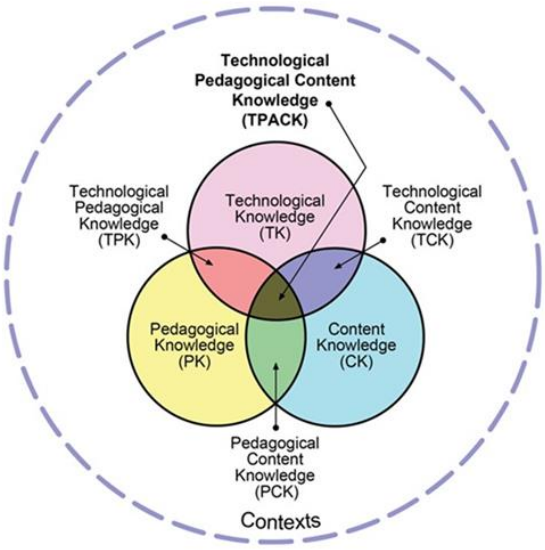
TPACK framework (Mishra & Koehler; 2006) was the theoretical framework guiding this study. TPACK is rooted in PST education with the goal of future teachers to know and increase confidence in classroom technology integration. TPACK was designed to clarify and help teachers organize technology use among the constantly evolving and changing relationships between content, pedagogy, and technology. By empowering teachers to view these three elements as distinct and individual yet working together, TPACK supports the teacher in using technology effectively and successfully in their classroom.

As technology has grown across society, the use of technology has increased within education (Molnar et al., 2019; National Association for the Education of Young Children,

2012). Unfortunately, having technology available for teacher use does not equate to *effective* use of technology (Chai et al., 2013; Koehler & Mishra, 2009; Mecoli, 2013). Teachers have voiced this challenge for years: how can technology be effectively used in the classroom? Typically, the response to teachers' challenges is professional development. However, technology-driven professional development is focused on using the technology and is disconnected from content knowledge and pedagogy (Ali et al., 2020; Chai et al., 2013; Koehler & Mishra, 2009). Knowing how a piece of technology works and understanding how to connect it to the teaching or learning task at hand are entirely different. TPACK addresses this disconnect and provides teachers support to make intentional links between technology and learning (Mishra & Koehler, 2006).

Figure 1

TPACK Framework



TPACK (2012). *TPACK Framework.* http://tpack.org/

TPACK has three main parts: technology knowledge, pedagogical knowledge, and content knowledge (Koehler et al., 2013; Mishra & Koehler, 2006, 2009). Technology

knowledge (TK) focuses on *how* the various technology pieces work: smartboards, iPads, laptops, computer software, etc. Considering most technological devices were not created with education in mind (Koehler et al., 2013), this piece of the framework solely focuses on the mechanics of the technology (Koehler et al., 2013; Mishra & Koehler, 2006, 2009). Pedagogical knowledge (PK) is the teacher's knowledge about how to teach the specific lesson, including classroom management, understanding how students learn, and how students construct knowledge (Chai et al., 2013; Koehler et al., 2013). PK goes beyond the content and looks at the student to understand where the student is cognitively, socially, and emotionally. The teacher also uses their PK to look at the entire group of students in their class and navigate the various community dynamics. Content knowledge (CK) is the teacher's knowledge about the subject being taught: the concepts which make up the subject area, the age-appropriate learning objectives, and the critical organization of the learning goals (Chai et al., 2013; Koehler et al., 2013). CK has multiple layers within each concept: the previous skills and concepts the student already learned or mastered and the future skills and concepts which will build upon the current skills and concepts. CK also covers the subject-matter which could involve letter recognition, number recognition, animal habitats, etc.

Within TPACK, the parts are seen individually, two parts working together, and all the parts working as a whole framework (see Figure 1; Koehler et al., 2013; Mishra & Koehler, 2006, 2009; TPACK, 2012). The parts working together present: technological content knowledge (TCK), pedagogical content knowledge (PCK), technological pedagogical knowledge (TPK), and as a whole: technological pedagogical content knowledge (TPACK). TCK is the depth where technological knowledge is applied to content knowledge and vice versa. This is specifically using technology in connection with the targeted subject: the teacher understanding

the district-approved software highlighting phonemic awareness. The area where PK and CK merge is when the teacher transforms the subject matter for teaching and learning (Chai et al., 2013; Koehler et al., 2013). Adaptations occur, individualizations to meet students' needs happen, and various ways to represent the material take place. Also, the teacher reads how the students are learning or not learning, changes the teaching approach, and assesses where the students are in learning and comprehension. Overall, a deep awareness occurs between the teacher, the content, and the students where PK and CK come together.

TPK is technological knowledge and pedagogical knowledge (Koehler et al., 2013; Mishra & Koehler, 2006, 2009). The teacher will apply their teaching strategy and understanding of the student being taught to the technology being used. An example of TPK is choosing an iPad over a laptop for a PreK student to use. Understanding the skill level of a four-year-old would give great insight to this decision. Another example would be offering typing lessons for third graders as they transition away from iPad use to laptop use. Teachers have great insight in this specific area since they know first-hand their students' skill levels. At the core of the framework is TPACK. All components work together: the teacher utilizes their pedagogical knowledge to teach the subject matter utilizing the available technology pieces effectively.

The final aspect of the TPACK framework is the outer-dotted circle labeled *contexts* (see Figure 1; TPACK, 2012) which refers to the various contexts in which teaching occurs (Koehler et al., 2013). For example, context could include the subject being taught (e.g., literacy, science, or a project-based approach unit) or the various dynamics the teacher must navigate. Context provides the overall picture as to the lesson being taught. For this study, the context is the COVID-19 Pandemic.

Definition of Terms

The following terms will be used in this study:

1. Brick-and-mortar: term to categorize a school that utilizes a physical structure (Miron & Urschel, 2012)
2. Developmentally appropriate practice(s): framework designed by NAEYC to provide research-based practice for children ages birth to 8 years; abbreviated DAP (National Association for the Education of Young Children, 2020)
3. Early childhood education: childcare and educational settings for children ages birth to 8 years; abbreviated ECE (National Association for the Education of Young Children, 2020)
4. In-person learning: teaching content is delivered in person utilizing non-Internet-based methods within a brick-and-mortar setting; also known as face-to-face instruction (Watson & North American Council for Online Learning, 2008)
5. Virtual education: mode of education that uses the Internet to provide a portion or all the student's learning opportunities (National Forum on Education Statistics, 2015)

Review of Literature

Virtual education derived out of the constant expansion of technology and the digitally demanding world (Kennedy & Archambault, 2012). Beginning within higher education, influencing secondary, and then residing in elementary education, virtual education was on course to be an accepted mode of education by 2025 *before* the COVID-19 Pandemic (Kennedy & Archambault, 2012; Palvia et al., 2018). As of May 2019, thirty-nine states within the United States had either virtual or blended programs; blended is when some of the instruction occurs in-person and the remaining part of instruction occurs virtually (Molnar et al., 2019). In 2017-18, there were 297,712 students enrolled full-time in virtual schools and 132,960 students enrolled in a blended virtual setting.

As the use of the Internet expanded across the globe, so did technology use, availability of devices, and virtual education (Garcia & Weiss, 2020; National Forum on Education Statistics, 2015; U. S. Department of Education, 2010). The ECE field has not been excluded from this growth (Tzuo et al., 2015). Technology has expanded to include ECE students in the classrooms and their homes (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019; Vaughan & Beers, 2017).

As virtual education grows across the nation and globe, research has followed suit. Research shows positive effects related to blended face-to-face learning and online learning for medical training or higher education. However, these findings are limited for K-12 and even more so for preschool (Molnar et al., 2019; Office of Planning, Evaluation, and Policy Development, 2010). Wang et al. (2009) advocated for future research to recognize and verify successful technology designs which implement influential teacher supports that help children's inquiry-based learning experiences. It was also noted that instructional technologies should be used in early childhood inquiry education. As the defined research-based practices have been laid out by NAEYC (2020), the whole child is seen and is affected by teaching methods. The use of technology has also increased among ECE organizations and families. However, awareness about the growing trend of virtual education among ECE teachers has not. Pila et al. (2019) state that only 53% of ECE teachers are familiar with the NAEYC/Fred Rogers Center (2012) published statement highlighting the recommended use of technology in ECE, a 1% increase from 2014.

Due to the growth of technology within society and within ECE (Park & Hargis, 2018), NAEYC and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College released a position statement (National Association for the Education of Young Children,

2012). The joint position statement's purpose was to offer support for ECE teachers on when, where, and how to utilize technology for student learning as technology and interactive media were recognized as not diminishing within society but as constants. Also, the statement reflects the research and guidance of the American Academy of Pediatrics and the White House Task Force on Childhood Obesity (2010) by stating that technology and interactive media can be used to promote learning and development *when* used intentionally. However, the intentional use must be geared to support the individual learning goals of the developing child. The statement continues to stress that DAP must guide decisions about use and integration of technology and that the professional judgment of the ECE teacher is necessary to determine if the technology available is appropriate for the age of the child and the individuality of the child, including the child's cultural and linguistic development. Recognizing that effective uses of technology and media engage the developing child and promote hands-on interaction, scaffolding and support for the learning child needs to be provided. NAEYC and Fred Rogers also emphasize the power of play and imagination within the use and incorporation of technology. The position statement concludes with a deep sense of urgency for further research on the short-term and long-term effects of technology and interactive media use for the developing child.

Looking at the path ECE teachers take prior to entering the classroom, research has expanded to include PST programs within higher education. One consistent gap within teacher preparation is the pedagogical connection to technology (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019; Vaughan & Beers, 2017). PST programs have been urged to develop curricula that build PSTs confidence in technology use (Alelaimat et al., 2021). Understanding more about the virtual teacher's role and abilities can guide this development, and better prepare future teachers (Baran et al., 2011). Connecting the technology use to the curriculum in rich

meaningful ways is where PSTs lack. Some have advocated more synchronous experiences for students and more professional development for teachers to help combat this concern (Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016). Bautista and Boone (2015) explained how technology is used at the preservice level to increase science self-efficacy among educators. Increasing the complexity, Kennedy and Archambault (2012) noted that online teaching or virtual teaching and face-to-face teaching in the traditional brick-and-mortar platform are not the same, and teaching preparation must be different.

Methodology

This study utilizes a mixed-method design to gain perspective from ECE teachers who had to alter their teaching strategies to accommodate virtual instruction during COVID-19. In addition to connections with technology, pedagogy, and content, teachers also shared their assessment strategies used while teaching virtually (Bazeley, 2013; Miles et al., 2017). By examining these areas, this study hopes to contribute to the rapidly growing literature on ECE virtual education (Alelaimat et al., 2021; Chai et al., 2019; Rizk, 2020).

Participants and Setting

Purposeful sampling was used to select the 99 participants based upon three conditions: grade teaching, mode of teaching, and overseeing as an administrator (Merriam & Tisdell, 2016). The 99 survey participants either taught virtually PreK through 3rd grade or oversaw at least one virtual teacher who taught PreK through 3rd grade. Emails were sent to three education organizations, and various social media posts on fifteen education groups were made to recruit participants. Twenty-five of the 99 participants participated in one-on-one interviews. Ten of the interview participants taught virtually PreK through 3rd grade in a brick-and-mortar organization. Nine interview participants were administrators overseeing virtual teachers in a

brick-and-mortar organization. The final six interview participants taught virtually PreK through 3rd grade from a virtual organization. All interview participants noted their formal education and teacher training occurred as brick-and-mortar educators and all previously taught in-person at brick-and-mortar organizations. Participants submitted consent forms prior to participation. The participant chose a pseudonym, or the researcher chose one to conceal their identity.

Professional information, including demographics, was collected during participation (Bazeley, 2013). Questions about professional training revealed that 60% of participants received their training and education as educators while earning bachelor's or master's degrees, traditional certification, and vast years of teaching experience (see Table 1).

Table 1

Survey Participant Distribution

Category	Distribution
Gender	58 Female (59%) 4 Male (4%) 37 Chose Not to Answer (37%)
Race	1 African American (1%) 1 Asian (1%) 45 Caucasian (46%) 3 Hispanic (3%) 2 Latino (2%) 8 Native American/American Indian (8%) 39 Chose Not to Answer (39%)
Highest Level of Education	25 Bachelor's Degree (25%) 33 Master's Degree (33%) 1 Doctor of Philosophy (1%) 40 Chose Not to Answer (41%)
Path of Certification	9 Alternative Certification (9%) 52 Traditional Certification (53%) 38 Chose Not to Answer (38%)
Type of Certification	11 Administration (11%) 15 Early Childhood Certified (15%) 16 Elementary Certified (16%)

	10 Early Childhood and Elementary Certified (10%)	
	4 Secondary Education Certified (4%)	
	1 Special Education Certified (1%)	
	42 Chose Not to Answer (42%)	
Location of Teaching	4 Taught Outside of the United States (4%)	
	85 Taught Inside the United States (86%)	
	10 Chose Not to Answer (10%)	
Years Taught in Person	0 – Less than 1 Year	6 – 1 Year up to 3 Years
	8 – 3 Years up to 6 Years	16 – 6 Years up to 10 Years
	14 – 10 Years up to 15 Years	9 – 15 Years up to 20 Years
	9 – 20 or more	37 – Chose Not to Answer
Type of School	9 Charter	2 Private
	50 Public	38 Chose Not to Answer
Years Taught Virtually	6 – Less than 1 Year	31 – 1 Year up to 2 years
	17 – 2 Years up to 3 Years	2 – 4 Years up to 6 Years
	2 – 6 Years up to 8 Years	2 – 10 Years up to 14 Years
	28 – Chose Not to Answer	
	The 11 Administrators were not allowed to answer	

Note. This table demonstrates the depth of experience among the participants.

The settings within this study varied. There were no restrictions on whether the participant taught in a public, private, or charter; the only requirement was that the teacher had to have taught PreK – 3rd grade virtual for some time or have been an administrator overseeing at least one virtual teacher meeting the requirement as mentioned earlier. Twenty-one interviews

happened via Zoom or the phone depending upon the participants' request. In addition, four interviews occurred in person at the participants' classroom or office.

Data Sources and Procedures

5-Point Likert Scale Survey Responses. Ninety-nine participants answered 19 5-point Likert-scale survey questions using a drop-down option through Qualtrics (see Appendix A). Responses ranged from 1 being strongly disagree and 5 being strongly agree with 3 being neither agree or disagree. The 19 questions were divided into four sections, each highlighting one aspect of the TPACK framework: Pedagogical Content Knowledge (PCK), Technological Content Knowledge (TCK), Technological Pedagogical Knowledge (TPK), and TPACK (Technological Pedagogical and Content Knowledge; Koehler et al., 2013; Mishra & Koehler, 2006, 2009). Survey questions came from "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009a).

Open-Ended Survey Responses. Nine open-ended survey questions focused on measurable gains, strategies used while teaching virtually, and curriculum (see Appendix B). Responses were not limited to length, and the format encouraged each participant to share their virtual teaching experience (Bazeley, 2013). Open-ended survey questions came from a preliminary study conducted by the researcher in which seven ECE educators were interviewed one-on-one.

Teacher Interviews. Sixteen semi-structured interviews were conducted (Grbich, 2013). Interviews ranged from 15 to 40 minutes depending upon the participants' responses and elaboration. Interview questions were written based upon "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (See appendix C; Schmidt et al., 2009a). The origin of this survey was to measure PSTs TPACK through self-assessment (Schmidt et al., 2009b, 2009c,

2009d; Shin et al., 2009). Therefore, the questions centered around TPK were used within the interview (see Appendix A). Creators of the survey approved the use of the survey for this study. In addition to this survey, the ECE teachers were asked to share their perception of TPACK and assessment methods connected with virtual education.

Field Notebook. The researcher used a notebook to record and reflect personal thoughts and analysis through the duration of the research, including the review of the literature process (Bazeley, 2013). Before each interview, the researcher organized information and then reflected upon the interview by using the field notebook.

Quantitative Data Analysis. The 99 survey responses were given a weight: strongly disagree was given the value of 1 and then to 5 for strongly agree (Schmidt et al., 2009a). Each construct was averaged. The TPACK construct was run first to explain any variance solely by the PCK utilizing IBM SPSS Statistics (Version 27) predictive analytics software. The TPACK construct was then run solely by TCK and then TPK. Next, control variables such as teacher education, years of experience teaching virtual, and total years of experience teaching were added to explain more of the variation during each iteration. After assumptions were met, ANOVA analysis was run to determine any statistical differences among TPACK and the same control variables.

Qualitative Data Analysis. The open-ended responses were uploaded to Dedoose to be analyzed. To answer the first research question, in vivo and structural codes were used to identify and categorize the participants' responses for TPACK (Miles et al., 2017). For the second research question connected to assessment, first cycle coding was completed using in vivo and structural codes. Second cycle coding derived from the emerging patterns, including formative, summative, and educator perception.

All interview audio recordings were uploaded to Otter.ia for transcription. The researcher made corrections as needed and then sent the transcripts to participants for member checking (Bazeley, 2013). Once approved by participants, transcripts were then analyzed in Dedoose. The same coding framework was used for the open-ended responses.

In addition, the researcher used the field notebook throughout all data analysis to document thoughts, observations, and connections to the literature and within the data (Bazeley, 2013).

Trustworthiness. Determining validity and reliability are pivotal for ethical qualitative research (Merriam & Tisdell, 2016). All procedures were approved through the university Institution Review Board. Email was used to communicate with each qualified participant and phone per participant request to schedule interviews and share Zoom links. The researcher kept an audit trail to organize data collecting, data analyzation, and member checking (Bazeley, 2013). Triangulation was used to check the findings through the survey, interviews, literature, and field notebook. The researcher concluded with various evaluations by using these methods. To counter bias, the researcher participated in weekly debriefing meetings with her professor and colleagues.

Limitations. There are two specific limitations within this study. The 19 brick-and-mortar interview participants were hired to teach in-person and as a result of the COVID-19 Pandemic, had to pivot to virtual instruction. This change in teaching platform is viewed as a limitation because the educators were not hired specifically to teach virtually within a virtual platform. Research does show virtual instruction is not the same as in-person instruction (Kennedy & Archambault, 2012; Keaton & Gilbert, 2020). It is unknown if the remaining survey participants were hired to teach in-person or virtually. Many participants did not answer all the demographic

questions (see Table 1). It is unknown why participants did not answer all the demographic questions. This is the second limitation in this study.

Findings and Discussion

The ECE teachers within this study reflected a rich group of experienced participants holding multiple certifications and education. After analyzing the data, themes emerged and are discussed below that answer the two research questions: Do virtual teachers display confidence while implementing pedagogy and technology and content with ECE virtual students? How do virtual teachers assess student learning?

TPACK Self-Perception

Participants responded to 19 questions from the Survey of Preservice Teachers' Knowledge of Teaching and Technology (see Appendix A; Schmidt et al., 2009a). Through this self-reflection, averages of each TPACK component were calculated (see Table 2). The lowest average of the 99 participants was the TPACK overall component (3.80). Collectively, teachers neither agreed nor disagreed that they could teach lessons that properly merge the various content areas with technology and teaching approaches. This average shows a lack of confidence in the overall execution of TPACK. TCK was the next average (3.88) which also falls within the same realm of neither agree nor disagree and displays a lack of confidence in combining technology *with* a specific content area such as math, literacy, science, and or social studies.

PCK (4.04) and TPK (4.22) both displayed teacher confidence. Teachers agreed that they could choose efficient teaching approaches in content areas such as math, literacy, science, and or social studies. Teachers had confidence in these two areas by using videos of themselves, anchor charts, interactive games, direct instruction, collaboration with other teachers, and hands-on activities. The highest average among the TPACK components was TPK: connecting

technology in a pedagogical-sound manner to the content areas. Interestingly, this was the area that teachers voiced during interviews that they struggled with during virtual instruction and the area in which they wanted professional development to specialize.

Table 2

Averages of TPACK Components

Component	Average
TPACK	3.80
TCK	3.88
PCK	4.04
TPK	4.22

Note. This table lists the averages of the 99 participants' self-ratings of their TPACK.

The variance in TPACK was explained greater by TCK (35.6%) and TPK (36.8%). PCK only had explained 16.6% of the variance of TPACK. This variance difference revealed the power that technological knowledge has on the overall TPACK. When teachers knew *how* the piece(s) of technology worked and *how* to connect the technology to the content or pedagogically, they had higher confidence in classroom technology integration and connected the technology pedagogically to the chosen content. Using interactive quizzes, multi-sensory games, and the Zoom chat box for exit tickets were just a few examples of how teachers displayed their confidence with technology. But when the technological knowledge was removed, the confidence in classroom technology integration was only altered 16.6% based upon the teacher's ability to connect the content pedagogically. Teachers knew how to connect math, science, literacy, and social studies to the targeted audience. During the ANOVA analysis, a variance of 12.5% for TPACK was explained by teacher's certification status, total years taught

(in-person and virtual), and education level. Replacing total years taught with total virtual years taught, the variance went down to 10.5%. Overall, the teacher's technological knowledge was the greatest explanation of variance within the teacher's confidence in classroom technology integration. All variables had positive correlations with teacher confidence, yet none registered as significant.

Virtual TPACK: Support is Needed

Overwhelming, teachers discussed the lack of professional development targeted to technological pedagogical connections.

> [The school district] did trainings on Seesaw [digital platform] and the Screencast [video recording software]. I am trying to think if there was anything else. I wish there would have been more of a training on truly doing virtual teaching. (Joan)

Sally, another teacher, agreed with Joan's opinion as well. Sally shared how she relied heavily on collaboration with other virtual teachers to reflect on what was working and discuss challenges which were arising:

> I don't feel that there was any professional development that was super helpful on what we were doing, I felt like [the support the district provided] came to us was too late, because we needed it *now*. And so that's why I found my own people to talk to and my own resources to look at. What my district did do well was create a virtual teacher support group class. We could all help each other. And more importantly, just talk to each other about what was working, what's not working, what problems we're having. Because since we're all using basically the same curriculum, and we're all using basically the same formats and technologies, the problems are all the same, and we all share them. It was a

> lot easier to work through that with a group and just had that support from each other. (Sally)

In addition to lacking the pedagogical connection, teachers also described how they had to *find* professional development or were not compensated *for* the professional development they participated in that was provided by their districts. “I don't think a lot of [the professional development] helped me. I just figured it out on my own. To be honest, just trial and error… I did some virtual professional development [on my own] during that time” (Maria). Claire described how she was expected to attend professional development offered by her district yet not provided the time to do so:

> We are not getting compensated nor are the hours built in. We have probably two to three plan times a week that are available and not being used for meetings. But our distance learning days are set aside for district and site professional development as well as [other] meetings…And now it's just the expectation that you find time to make it work, which I think is creating a little bit of, not necessarily procrastination, but lack of motivation for teachers to get it done, because we just don't have the time.

Participating in professional development not targeted to the current need(s) within the classroom is not new to the teaching profession (Cordingley et al., 2015; Darling-Hammond et al., 2017). Research has advocated for more synchronous experiences within professional development for teachers (Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016). By utilizing district-provided technology and the expected grade-level curriculum, teachers would be able to connect the technology use to the curriculum in rich meaningful ways through professional development.

Virtual Assessment Strategies

For assessments to occur virtually, teachers used a few classroom management strategies, such as changing the group size. When the group was larger (than 5 students), teachers from all grade levels shared that their ability to document, assess, and record the students' abilities was challenging. For some summative assessments, such as reading, teachers would schedule one-on-one time with each student to complete the scheduled assessment. Claudine explained her intentionality to use every available minute to be with a student virtually to gain a better understanding of what the student needed so she could make an individual plan of action: "My parents knew at that time that if I have free time, I'm going to call your child over to do this check or that check. So, [my students] had quite a bit of one-on-ones."

In addition to keeping running records, teachers relied on the Zoom recordings with students to gain data for their formative assessments: "And the Zoom calls were also recorded. If I missed something, I was able to go back," Veronica explained. Other teachers shared this same strategy to ensure they did not miss anything from the students. PreK and kindergarten teachers used parents submitting pictures of completed work or specific tasks to document learning. First grade through 3rd grade teachers used interactions with the students during live teaching sessions and completed work on the digital platform for formative assessments. These strategies mirrored the work of Serravallo (2020). Her book encouraged teachers to vary their assessment modalities to provide different avenues for students to display what they know. In addition, she advised teachers to create a skill progressions map for students to note progress, offer feedback, and set goals as needed. This skills progression map can assist the teacher in targeting the areas the student is lacking in or is struggling with. The learning objective is set and written out, then the teacher works the path backwards on what is needed *to reach* the learning objective.

Organizing the day to accommodate small groups, multiple one-on-one assessment time, and watching recorded group lessons meant teachers were working past their contract hours. Many teachers noted that they were working two to four hours extra every day to ensure assessments were completed and students were properly served.

> It was hard to stop working at 2:15 or 3:00. The first semester just ate me alive. Because if a parent messaged me at 3:30, I felt like I needed to help their kids still. When we came back from Christmas, I was like, 'Nope, I'm not answering at this point.' I had a couple [of parents] that wanted help with their kid at 4:00 in the afternoon. And I had to say no, and that was really hard. I think virtual should be 'These are my hours.' and it can be whatever. I would have been happy to do like 10 [in the morning] to whatever, you know, adjusting it to later hours for the families because I think everyone would have been happy with that. (Dominique)

Navigating the extra steps to ensure assessments were complete and students' needs were met was challenging for the teachers. Even though teachers spent extra time working with their students, they felt frustrated because student growth was not progressing at the same rate with in-person instruction. Teachers would encourage more use of the individualized apps to help target where the student needed additional help. However, growth did not occur as expected. As a result, frustration set in and teachers began making plans to communicate with the next year's teachers about assessment results, interventions that were tried, and gaps they felt needed to be filled. Teachers also wanted to begin preparation for their students coming in from the previous grade by reaching out to those teachers and asking what the learning gaps were and their view of how to better prepare for the upcoming school year. This plan of action aligns with Garcia and Weiss (2020). At the beginning of the COVID-19 Pandemic, educators were already seeing a

change in student performance and growth. Their plan of action included providing immediate resources to schools to provide effective virtual learning, additional investments for students and schools to catch the students up, and redesigning the school's system to focus on the whole child. The teachers within this study were proactive by preparing for their incoming students and collaborating with colleagues to focus on the whole child.

Engagement is the Standard

Teachers expressed how they used engagement as a prominent standard for successful teaching strategies.

> The level of student participation was one of the indicators of successful teaching strategies. When students asked questions or referred to certain kinds of games we played on Zoom while learning math, or requested smaller group writing sessions on Zoom, because I took the time to listen to their ideas and gave them tips to write, was a strong indicator that something was working. I saw that engagement level continue when these students came back in-person with me, mid-year. (Nita)

Teachers described engagement as student participation (in conversations, lessons, and games), present during the entire lesson, eye contact, and evidence of skill progression being taught, and overall enjoyment of learning.

Using engagement to *be* the standard requires first for students to *be* engaged. If students were not engaged, teachers adapted and changed their teaching strategies. The teachers did not allow technology to impede student engagement. They reworked the problem and found solutions:

> And then I would also look through [teaching websites], see what pops up and then go from there as to adding different links that go along with science or some math songs or

> something. Anything that can try to get them more engaged with the material, since they're so little, you know. They're not going to just sit and listen to me talk online, we needed anything that has a lot of good visual and songs. (Shannon)

Teachers with 20 years' experience also voiced the need to adapt and strategize for new engagement opportunities.

> [Teaching virtual] has taught me to think outside the box. And to not be afraid to try different things with your students to give them a little bit of nudge and a little bit of a push. And you can still engage them. Even if you're not sitting right in front of them. There are just different ways to do it. (Mary)

The teachers' importance on engagement is supported through research (Garcia & Weiss, 2020; Gill et al., 2015). Garcia and Weiss (2020) noted that, as a result of the significant influx into virtual and distance learning, as a result of COVID-19, the digital divide among disadvantaged students made it harder for students to be engaged in the learning. If the student was not familiar with navigating or working the technology, their engagement level would decrease. Furthermore, Garcia and Weiss noted that student's self-engagement had a strong connection with the student's performance in virtual school and success. The teachers within this study recognized the importance of student engagement. Furthermore, research recognizes the challenge of *getting* virtual students to *be* engaged (Gill et al., 2015). This challenge alone was cited among school administrators three times as often as any other issue in virtual education.

Parental Involvement

Another complex dynamic of virtual assessment was parental involvement. The teachers of the PreK and kindergarten grades welcomed and solicited parental assistance in assessing social-emotional learning, gross motor skills, and fine motor skills.

> Now, there was a couple of teaching objectives that I needed the parents' help. They would help collect some of the data that I was not able to see. Like all those social emotional objectives, whether interacting with peers and regulating their emotions. I couldn't assess that, because I wasn't there. I didn't get to see them in a group setting. I would actually ask the parents, 'While [your student is] with friends or with family members, or cousins, can you send me photos of them doing this or videos?' And parents would have to supply me with those. (Veronica)

The PreK and kindergarten teachers would rely on parents to send videos and pictures of the student completing the specific task or learning objective, and then the teacher would assess through the submitted documentation. However, the teachers of 1st through 3rd grades were very skeptical and questioned parental help during virtual assessments.

> And the first time we gave [the STAR reading test], we had these really inflated scores. And we were like 'These parents are cheating!' And I kept thinking parents aren't cheating, like, parents know not to cheat. But I realized, when I was making dinner for my own kids one night, my son asked me a question when he was doing work. And I answered it. And I had like this epiphany. 'This is this is exactly what's happening!' Parents have no idea. I knew my son was doing something for school. But I mean, no one said to me, 'This is this is a norm-referenced computer-based assessment that we're going to be measuring their reading, so don't help.' They just gave him the STAR test. He is taking this test and I am answering questions. (Marta)

The PreK and kindergarten teachers appreciated the parental support in ensuring the student logged on for live sessions and completed work. However, they wondered if there was a way to educate and inform parents about virtual assessments and how in these early grades, it was okay

if the student did not show mastery of the skill. As a result of the authentic assessment displaying the student's true ability and skill level, which was not fabricated or elevated due to adult help and support, the teacher grasped a better idea of where to meet the student and how to better support them (Zurek et al., 2014).

> And so [virtual learning] consistently was more and more challenging. Because we knew that we could not educate parents [how to do virtual learning] at the same time of trying to [make virtual learning happen]. At the same time, we were trying to determine what was the best delivery model for that early childhood virtual instruction. (Maria)

Teachers knew parents were struggling with their role within virtual education, but at the same time they did not have the time or the knowledge to teach parents their role. Gaining insight into the parents' role in virtual learning is expanding. Alamsyah (2022) studied the roles of parents during the COVID-19 Pandemic and concluded that the parents' personal education level and the various jobs connected or not connected to education influenced their child's learning process. Alamsyah also noted that the need for parental involvement for the younger grades was greater and could become more of a challenge since parents might not fully understand the learning process at this age. Understanding and utilizing parental help while virtual teaching was challenging for the teachers, especially when the task was connected to assessment.

Conclusion

Connections

As schools across the globe had to change their teaching delivery methods at a moment's notice, teachers were forced to use their training and experience in ways they never dreamed of before (Garcia & Weiss, 2020; United Nations, 2020). Due to this massive change in instruction, this study looked to answer two research questions. The first question: Do virtual teachers

display confidence while implementing pedagogy and technology and content with ECE virtual students? The teachers who participated in this study reflected the most confidence in TPK and the least in TPACK. Even though the confidence was the highest with TPK, it was still within the low range of "Agree" and not "Strongly Agree." This overall ranking of TPK was linked to the teachers' need for professional development connected to pedagogy. The teachers' confidence would have been higher if targeted professional development was in place prior to pivoting or even while virtual instruction was taking place (Bates & Morgan, 2018). In fact, teachers used their own time and resources to seek professional development to help support this transition to virtual.

This study also looked at a second research question: How do virtual teachers assess student learning? Through summative assessments which were completed in small groups or one-on-one, teachers relied heavily on making every minute count while assessing a student. For formative assessments, teachers kept running records, reviewed recorded Zoom sessions, and even called on parents to submit specific photos or video footage. Using a variety of assessment modes allowed students to have different opportunities to demonstrate their knowledge (Serravallo, 2020). Teachers also changed their delivery methods and found alternative ways to teach virtually to improve student engagement. This reaction aligned with Abou-Khalil et al.'s (2021) study which focused on engagement strategies for online learning. The researchers concluded that teachers must have effective interaction with the students and diversify their delivery methods.

A final connection from this study relates to parental communication. PreK and kindergarten teachers asked parents to submit photos, videos, and finished student work. The teachers used these submissions to assess the students' abilities. First through 3rd grade teachers

approached this differently. They wanted students to submit *their* own work, work that was not corrected by a parent. The older grade level teachers wanted to know what the student could do independently. Communicating the reasoning behind students submitting their own work was not expressed by the teachers. Research has shown ECE students benefit from teachers and parents supporting their learning process rather than providing direct answers (Alamsyah, 2022; Zurek et al., 2014). Parents spending time with the student as the student works through the assignment while providing encouragement is an example of parental support (Alamsyah, 2022). An additional form of support is the teacher and the parent asking inferential questions to the students (Zurek et al., 2014). *How did you solve this? Why is this the answer?* Rather than correcting or providing direct answers, parents can provide support for their student as they learn.

Implications for Schools, Districts, and Teacher Education Programs

Now that many ECE teachers have gained experience teaching virtually across the country due to COVID-19, specialized professional development needs to be made available for DAP (NAEYC, 2020) connected to technology (Lockee, 2021; Philipsen et al., 2019). By concentrating on DAP (National Association for Education of Young Children, 2020) linked to technology, such as the ECE student having the autonomy to freely create within a computer application, the context of virtual learning is highlighted by modeling for teachers *how* to make this critical connection between technology and pedagogy. As a result, teachers gain TPK confidence. This targeted support is the first implication of this study and is connected to the first gap. This study supports the need to connect pedagogy and technology still exists and also contributes by incorporating DAP within targeted preservice teacher programs and professional

development specifically connected to technology, the connection between pedagogy and technology will strengthen.

Regarding assessment, which is the second implication, virtual teachers need to be encouraged and supported to be flexible in their assessment and engagement strategies. By placing less restrictive boundaries upon teachers, they will be able to change and accommodate to meet the needs of their students. Teachers recognize when students are engaged and they need to have the autonomy to pivot and change their delivery methods to ensure and increase engagement (Abou-Khalil et al., 2021). By giving teachers autonomy to alter assessment and engagement strategies, students will be able to display and show the teacher their understanding; this connects to the second gap.

Finally, teachers need to communicate to parents how they can support their ECE student through scaffolding (Zurek et al., 2014). Scaffolding is a common teaching strategy used to promote and encourage a natural learning process for students. Describing the process of scaffolding as a toddler learning how to walk and how the parent is present to provide support but not physically touching the legs to move up and down can help the parent understand and visualize scaffolding through schoolwork. Encouraging the student to ask questions while they work is another scaffolding technique. Teachers can explain and model these techniques for parents through virtual education.

Teachers also need to explain to parents the benefit the student submitting their own work whether it is correct or not so the teacher can gain a clear picture of the student's ability (Alamsyah, 2022). This form of explanation can enlighten parents on how their student learns and how teachers help support the student moving forward. An opportunity to partner with parents is made possible and the parents gain understanding on how their student learns.

Communication can include explaining how teachers use students' work to gain insight into their understanding of the lesson. Also, stress and pressure can be alleviated from the parents who might feel that their student must submit only correct responses.

Through the chaos of the COVID-19 Pandemic, educators can reflect and learn from the decisions made. Virtual teachers can share their experiences and provide greater insight into the dynamics between the classroom and home. Virtual education is here to stay (Kennedy & Archambault, 2012; Palvia et al., 2018; Schwartz et al., 2020), researchers and educators can use this opportunity to better all facets involved: schools, districts, and teacher education programs.

References

Abou-Khalil, V., Helou, S., Khalife, E., Chen, M. A., Majumdar, R., & Ogata, H. (2021). Emergency online learning in low-resources settings: Effective student engagement strategies. *Education Sciences, 11*(24). https://doi.org/10.3390/educsci11010024

Alamsyah, A. (2022). Parents' role in supporting their children's online learning process. *Journal of Elementary Education, 6*(1), 138-145. https://doi.org/10.31004/basicedu.vgi1.1776

Alelaimat, A. M., Ihmeideh, F. M., & Alkhawaldeh, M. F. (2021). Preparing preservice teachers for teachers for technology and digital media integration: Implications for early childhood teacher education programs. *International Journal of Early Childhood, 52*, 299-317. https://doi.org/10.1007/s13158-020-00276-2

Ali, Z., Thomas, M., & Hamid, S. (2020). Teacher educators' perception of technological and content knowledge on their classroom teaching. *New Horizons, 14*(2), 17-38. https://doi.org/10.2.9270/NH.14.2(20).02

Atiles, J. T., Almodovar, M., Vargas, A. C., Dias, M. J. A., & Zuniga Leon, I. M. (2021). International responses to COVID-19: Challenges faced by early childhood professionals. *European Early Childhood Education Research Journal, 29*(1), 66-78. https://doi.org/10.1080/1350293X.2021.1872674

Baran, E., Correia, A., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education, 32*(3), 421-439. http://dx.doi.org/10.1080/01587919.2011.610293

Bates, C. C., & Morgan, D. N. (2018). Seven elements of effective professional development. *Literacy Coaching and Professional Development, 71*(5), 623-626. https://doi.org.10.1002/trtr.1674

Bautista, N. U., & Boone, W. J. (2015). Exploring the impact of TeachME Lab virtual classroom teaching simulation on early childhood education majors; self-efficacy beliefs. *Journal of Science Teacher Education, 26*(3), 237-262. https://doi.org/10.1007/s10972.014.9418.8

Bazeley, P. (2013). *Qualitative data analysis: Practical strategies.* Sage Publications, Inc.

Chai, C. S., Koh, J. H. L., & Tsai, C. (2013). A review of technological pedagogical content knowledge. *Journal of Educational Technology & Society, 16*(2), 31-51. https://www.jstor.org/stable/10.2307/jeductechsoci.16.2.31

Chai, C. S., Jong, M., Yin, H., Chen, M., & Zhou, W. (2019). Validating and modeling teachers' technological pedagogical content knowledge for integrative science, technology, engineering and mathemat-ics education. *Journal of Educational Technology & Society, 22*(3), 61-73. https://www.jsotr.org/stable/10.2307.26896710

Cordingley, P., Higgins, S., Greany, T., Buckler, N., Coles-Jordan, D., Crisp, B., Saunders, L., & Coe, R. (2015). *Developing great teaching: Lessons from the international reviews into effective professional development.* Project Report. http://tdtrust.org/about/dgt

Czerkawski, B. C. (2014). Designing deeper learning experiences for online instruction. *Journal of Interactive Online Learning, 13*(2), 29-40. http://www.ncolr.org/jiol

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective teacher professional development.* Learning Policy Institute. https://learningpolicyinstitute.org/ product/teacher-prof-dev

Garcia, E., & Weiss, E. (2020). *Covid-19 and student performance, equity, and U.S. education policy: Lessons from pre-pandemic research to inform relief, recovery, and rebuilding.* Economic Policy Institute. https://www.epi.org/ publication/the-consequences-of-the-covid-19-pandemic-for-education-performance-and-equity-in-the-united-states-what-can-we-learn-from-pre-pandemic-research-to-inform-relief-recovery-and-rebuilding/

Gill, B., Walsh, L., Wulsin, C. S., Matulewicz, H., Severn, V., Grau, E., Lee, A., & Kerwin. (2015). *Inside online charter schools.* Mathematica Policy Research. https://files.eric.ed.gov/fulltext/ED560967.pdf

Grbich, C. (2013). *Qualitative data analysis: An introduction* (2nd ed.). Sage Publications.

Keaton, W., & Gilbert, A. (2020). Successful online learning: What does learner interaction with peers, instructors and parent look like? *Journal of Online Learning Research*, *6*(2), 129-154.

Kennedy, K., & Archambault, L. (2012). Offering preservice teachers field experiences in K-12 online learning: A national survey of teacher education programs. *Journal of Teacher Education, 63*(3), 185-200. https://doi.org/10.1177/0022487111433651

Kim, J. (2020). Experiences of student teachers in an early childhood education practicum. *International Journal of Early Childhood, 52*, (145-158). https://doi.org/10.1007/s13148-020-00272-6

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *The Journal of Education, 193*(3), 13-19. https://doi.org/10.1177/002205741319300303

Lockee, B. B. (2021). Shifting digital, shifting context: (Re)considering teacher professional development for online and blended learning in the COVID-19 era. *Educational*

Technology Research and Development, 69. 17-20. https://doi.org/10.1007/s11423-020-09836-8

Mecoli, S. (2013). The influence of the pedagogical content knowledge theoretical framework on research on preservice teacher education. *The Journal of Education, 193*(3), 21-27. https://doi.org/10.1177/002205741319300304

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

Miles, M. B., Huberman, A. M., & Saldana, J. (2017). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Sage Publications, Inc.

Miron, G., & Urschel, J. L. (2012). *Understanding and Improving Full-time Virtual Schools: A Study of Student Characteristics, School Finance, and School Performance in Schools Operated by K12 Inc.* National Education Policy Center. http://neps.colorado.edu/publication/understanding-improving-virtual.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 10-17. https://doi.org/10.1111/J.1467-9620.2006.00684.X

Mishra, P., & Koehler, M. (2009). Too cool for school? No way! Using the TPACK framework: You can have your hot tools and teach with them, too. *Learning & Leading with Technology, 36*(7), 14-18.

Molnar, A., Miron, G., Elgeberi, N., Barbour, M. K., Huerta, L., Shafer, S. R., Rice, J. K., & National Education Policy Center. (2019). *Virtual Schools in the U.S. 2019.* School of Education. http://nepc.colorado.edu/sites/default/files/publications/Virtual%20Schools%202019.pdf

National Association for the Education of Young Children. (2012). Position Statement on Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8. https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/topics/PS_technology_WEB.pdf

National Association for the Education of Young Children. (2020). Position Statement on Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8 (4th ed.). https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/position-statements/dap-statement_0.pdf

National Forum on Education Statistics. (2015). *Forum guide to elementary/secondary virtual education data.* U.S. Department of Education. National Center for Education Statistics. https://nces.ed.gov/pubs2016/NFES2016095.pdf

Office of Planning, Evaluation, and Policy Development. (2010). *Evaluation of evidence-based*

practices in online learning: A meta-analysis and review of online learning studies. U.S. Department of Education. https://www.ed.gov/about/offices/list/opepd/ppss/reports.html

Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindhi S. (2018). Online education: Worldwide status, challenges, trends, and implications. *Journal of Global Information Technology Management, 21*(4), 233-241. https://doi.org/10.1080/1097198X.2018.1542262

Park, E. K., & Hargis, J. (2018). New perspective on TPACK framework in the context of early childhood education: The "A" stands for affective. *International Journal for the Scholarship of Teaching and Learning, 12*(2). https://doi.org/10.20429/ijsotl.2018.120217

Philipsen, B., Tondeur, J., Roblin, N. P., Vanslambrouck, S., & Zhu, C. (2019). Improving teacher professional development for online and blended learning: A systematic met-aggregative review. *Educational Technology Research and Development, 67.* 1145-1174. https://doi.org/10.1007/s11423-019-09645-8

Pila, S., Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2019). *Technology in the lives of educators and early childhood programs: 2018 Survey.* Center on Media and Human Development, Northwestern University. https://cmhd.northwestern.edu/wp-content/uploads/2019/08/NAEYC-Report-2019.pdf

Rizk, J. (2020). Considerations for implementing emerging technologies and innovative pedagogies in twenty-first-century classrooms. In S. Yu, M. Ally, & A. Tsinakos (Eds.), *Emerging technologies and pedagogies in the curriculum* (pp. 447-460). Springer. https://doi.org/10.1007/978-981-15-0618-5_26

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education, 42*(2), 123-149. https://doi.org/10.1080/15391523.2009.10782544

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). The continuing development, validation and implementation of a TPACK assessment instrument for preservice teachers. In *Proceedings of the 2010 Annual Meeting of the American Educational Research Association, Denver, CO*.

Schmidt, D., Baran, E., Thompson, A., Koehler, M., Punya, M., & Shin, T. (2009). Examining Preservice Teachers' Development of Technological Pedagogical Content Knowledge in

An Introductory Instructional Technology Course. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen & D. Willis (Eds.), *Proceedings of SITE 2009--Society for Information Technology & Teacher Education International Conference* (pp. 4145-4151). Charleston, SC, USA: Association for the Advancement of Computing in Education (AACE).

Schwartz, H., Grant, D., Diliberti, M., Hunter, G., & Setodji, C. (2020). *Remote learning is here to stay: Results from the First American School District Panel Survey* (No. RR-A956-1). https://eric.ed.gov/?id=ED614143

Serravallo J. (2020). *Connecting with students online: Strategies for remote teaching & learning.* Heinemann.

Shin, T., Koehler, M., Mishra, P., Schmidt, D., Baran, E., & Thompson, A. (2009). Changing Technological Pedagogical Content Knowledge (TPACK) through Course Experiences. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen, & D. Willis (Eds.), *Proceedings of SITE 2009--Society for Information Technology & Teacher Education International Conference* (pp. 4152-4159). Charleston, SC, USA: Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/31309/

TPACK (2012). *TPACK Framework.* http://tpack.org/

Topolovacan. T., Matjevic, M., & Dumancic, M. (2016). Some predictors of constructivist teaching in elementary education. *Croatian Journal of Education, 18*(1), 193-212. https://doi.org.10.15516/cje.v18i9.2217

Tzuo, P., Toh, L. P. E., & Liang, J. (2015). Early childhood teachers' views towards using constructivist internet-based environments to support children's learning activities: A mixed-methods study. *Australasian Journal of Early Childhood, 40*(1), 81-90. https://doi.org/10.1177/183693911504000111

United Nations. (2020). Education during COVID-19 and beyond. https://www.un.org/ development/desa/dspd/wp-content/uploads/sites/22/2020/08 /sg_policy_brief_covid-19_and_education_ august_ 2020.pdf

U. S. Department of Education. (2010). Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies. www.ed.gov/about/offices/list/opepd/ppss/reports.html

Vaughan, M., & Beers, C. (2017). Using an exploratory professional development initiative to introduce iPads in the early childhood education classroom. *Early Childhood Education Journal, 43*, 321-331. https://doi.org.10.1007/s1064301607723

Wang, F., Kinzie, M. B., McGuire, P., & Pan, E. (2009). Applying technology to inquiry-based learning in early childhood education. *Early Childhood Education, 37,* 381-389. https://doi.org/10.1007/s10643-009-0364-6

Watson, J., & North American Council for Online Learning. (2008). Blended learning: The convergence of online and face-to-face education. *Promising Practices in Online Learning.* https://files.eric.ed.gov/fulltext/ED509636.pdf

White House Task Force on Childhood Obesity. (2010). Solving the problem of childhood obesity within a generation. *Office of the President of the United States.* www.letsmove.gov/sites/letsmove.gov/files/TaskForce_on_Childhood_Obseity_May2010_FullReport.pdf

Zurek, A., Torquati, J., & Acar, I. (2014). Scaffolding as a tool for environmental education in early childhood. *International Journal of Early Childhood Environmental Education, 2*(1), 27-57. https://files.eric.ed.gov/fulltext/EJ1108033.pdf

Appendix A

ECE Virtual Teacher Likert-Scale Survey Questions

On a scale of 1-5; 1 being strongly disagree and 5 being strongly agree with 3 being neither agree or disagree.

PCK Questions

1. I can select effective teaching approaches to guide student thinking and learning in mathematics.

2. I can select effective teaching approaches to guide student thinking and learning in literacy.

3. I can select effective teaching approaches to guide student thinking and learning in science.

4. I can select effective teaching approaches to guide student thinking and learning in social studies.

TCK Questions

5. I know about technologies that I can use for understanding and doing mathematics.

6. I know about technologies that I can use for understanding and doing literacy.

7. I know about technologies that I can use for understanding and doing science.

8. I know about technologies that I can use for understanding and doing social studies.

TPK Questions

9. I can choose technologies that enhance the teaching approaches for a lesson.

10. I can choose technologies that enhance students' learning for a lesson.

11. I am thinking critically about how to use technology in my classroom.

12. I can adapt the use of the technologies that I am learning about to different teaching activities.

13. I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.

14. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.

15. I can choose technologies that enhance the content for a lesson.

TPACK Questions

16. I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.

17. I can teach lessons that appropriately combine literacy, technologies and teaching approaches.

18. I can teach lessons that appropriately combine science, technologies and teaching approaches.

19. I can teach lessons that appropriately combine social studies, technologies and teaching approaches.

[1]Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009a). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

Appendix B

ECE Virtual Teacher Open-Ended Response Survey Questions

1. What measurable gains do you have within your virtual teaching?

2. How do you know if your strategies are working?

3. How do you know the students are learning?

4. What strategies do you use to teach the content?

5. What methods do you use to teach the content?

Appendix C

ECE Virtual Teacher Interview Questions

Interview questions: *Participants have already completed the survey*

1. Tell me about some of the effective teaching strategies you use to guide student thinking and learning in your classroom.

2. How do you select these teaching strategies?

3. How do you choose the content to teach?

4. What curriculum do you have?

5. Tell me how these strategies are supported by the technology you use.

6. What other technologies do you use to enhance your lessons? How did you find these technologies?

7. Tell me about any professional development that has helped you?

8. How did you receive this professional development?

9. Was the professional development something you sought on your own or was it offered to you?

10. How do you measure student success in virtual education?

11. What are the tools teachers need to be successful in virtual education?

12. Are you using specific apps for individualization?

13. Talk about the process and how it helped you or not helped you.

14. Are you supporting other virtual teachers or mentoring them? What are some ways you are doing this?

15. This whole process (being trained as a brick-and-mortar educator and pivoting to virtual teaching) how has it helped you professionally?

16. Is there anything else you would like to add regarding virtual teaching within early childhood education?

[1]Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009a). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

MANUSCRIPT III

Brick-and-Mortar Teachers Go Virtual: Our World has Changed

This manuscript is prepared for submission to the peer-reviewed journal *Young Children* and is the third of three manuscripts prepared for a journal-ready doctoral dissertation.

Abstract

This article provides virtual teaching strategies that align with the National Association for the Education of Young Children's (NAEYC, 2020) developmentally appropriate practice guidelines. Meet Mary and Veronica as they share their teaching strategies and their experiences pivoting from brick-and-mortar to virtual teaching because of the COVID-19 Pandemic. Mary, a 1st grade teacher with 20 years in-person teaching experience along with a master's degree, describes the transition as teaching her "to think outside the box." Veronica, a pre-kindergarten teacher with nine years in-person teaching experience along with a master's degree, concluded that technology "can be an enhancer when used appropriately [in early childhood]."

Keywords: virtual education, early childhood education, developmentally appropriate practice, teaching strategies, COVID-19

Brick-and-Mortar Teachers Go Virtual: Our World has Changed

Millions of brick-and-mortar teachers had to pivot from in-person to virtual teaching and learning because of the COVID-19 Pandemic (Garcia & Weiss, 2020; United Nations, 2020). This pivot required teachers to adapt, immediately, to develop, use, hone strategies that were successful in the virtual platform. This adaption at times did not fit with professional best practices. Fifty-five million students in the United States became virtual education students, making it a common mode of education (Garcia & Weiss, 2020).

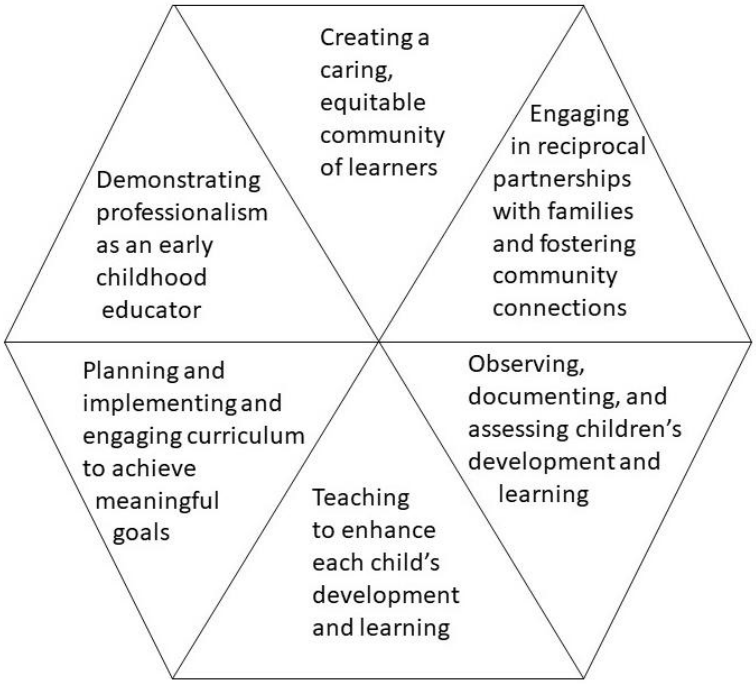
This article introduces two early childhood teachers: Mary and Veronica. Mary, a 1st grade teacher with 20 years in-person teaching experience along with a master's degree, noted the transition from teaching in-person to virtual required her "to think outside the box." Veronica, a pre-kindergarten teacher with nine years in-person teaching experience along with a master's degree, concluded that technology "can be an enhancer when used appropriately [in early childhood]." Each will share the strategies they pulled from their years of experience being brick-and-mortar teachers to change their delivery to virtual education. Their teaching strategies and professional perceptions align with the National Association for the Education of Young Children's (NAEYC, 2020) developmentally appropriate practice (DAP) guidelines and could be labeled as research-based practices. An overview of NAEYC's DAP guidelines is presented. Next, Mary and Veronica explain how they transitioned their entire pedagogical approach from brick-and-mortar to virtual. The DAP rooted strategies shared in this article can empower early childhood education (ECE) teachers to use technology as it continues to expand and grow in virtual education.

Developmentally Appropriate Practice Guidelines

ECE teachers consistently look to NAEYC for guidance on research-based practice or what is commonly known as DAP. The current DAP position statement promotes "the social and emotional development, physical development and health, cognitive development, and general learning competencies of each child served" (2020, p. 3). These guidelines are written to help ECE teachers make decisions within six interrelated areas and are displayed in a framework designed by the author for representation (see Figure 1).

Figure 1

NAEYC's DAP Guidelines



DAP is a framework that is intended to support the ECE teacher's decision-making process based upon commonality, individuality, and context (National Association for the Education of Young Children, 2020). NAEYC acknowledges the constant evolution of research within the field of ECE. DAP recognizes that "all development and learning occur within specific social, cultural, linguistic, and historical contexts" (2020, p. 6). Within the DAP

framework, the individual child is not only seen, but the individual child is also honored along with their family and community. The child's social and cultural settings are also included in DAP and are encouraged to be valued by educators when making decisions. NAEYC's DAP framework was used to highlight and give validity to the intentional strategies used by Mary and Veronica as they altered from brick-and-mortar teaching to virtual teaching. The following sections are the six DAP guidelines. Within each section, the teaching strategies are organized and will help other ECE teachers become better equipped to transition from brick-and-mortar teaching to virtual.

Creating a Caring, Equitable Community of Learners

ECE teachers are aware of the classroom environment and intentionally design the environment to promote learning (Goss & Sonnemann, 2017; Hancock & Carter, 2016); building the classroom environment virtually is no different (Sharla, 2019). To create the desired virtual classroom, Mary and Veronica were purposefully aware of group size, the intent of group time, and the length of group time during live meetings. Both used whole group time in the morning to create "camaraderie and a sense of belonging to a group" (Veronica). Mary explained how she used greetings just like in-person morning meetings: "Whether it was a fist bump or an air high-five, everything was through the screen. But we did it."

Both Veronica and Mary made it a habit to talk to the students who raised their hands and called on *all* students. To ensure this happened, the teachers kept a list of students' names close by and checked off each student who participated. "Sometimes in Zoom, the faces get moved around, and I started second-guessing myself whom I called on and whom I did not call on" (Veronica). Both teachers used smaller group sizes to encourage closer relationships among peers: "[Students] were able to talk with a group or with a partner" (Mary). Veronica and Mary

expressed how they worked with students individually when needed (e.g., writing pieces, specific learning objectives, and targeted assessments). Veronica also used mini-meetings throughout the day with groups of 2, 3, and even 1-on-1 meetings for fifteen minutes only.

An integral part of building an effective early childhood environment is intentionally highlighting social-emotional learning (Oberle et al., 2016). Veronica expressed how that social-emotional learning is just as important as math and language development and her scheduling reflected this belief. She scheduled social emotional lessons along with her other lessons. By incorporating social-emotional books during read alouds, a natural conversation about feelings and navigating big emotions could occur. Students shared special stuffed animals, family pictures, and even family pets to their peers through virtual show and tell times. By sharing their pets, special stuffed animals, and toys, connections were made among the students, and social-emotional learning was supported through virtual learning.

One final aspect of this first DAP guideline that both teachers were cognizant of, was to provide an equitable communication avenue for all students. Both school districts provided iPads for their students and even mobile hotspots for Internet capability. However, when challenges arose, both teachers used a free communication app: Remind: School Communication (Remind.com, 2013). This app was beneficial for parents with limited or no Internet access and for multilingual families whose English was not their primary language. Working with the parents' cell phones, *Remind* helped with consistent communication between the teachers and their students' families. Families and teachers were also allowed to send pictures and voice recordings to each other. Another benefit of *Remind* was that any typed communication could be translated into multiple languages at the push of a button. Through an additional form of communication, Mary and Veronica ensured that another component of an equitable virtual

community was provided for all their students. These examples of communication between the teacher and families are supported by Haiyudi and Art-In's (2021) study. They concluded that intensive communication between the teachers and the families helped students' academic gains during virtual learning.

Engaging in Reciprocal Partnerships with Families and Fostering Community Connections

ECE teachers recognize and value relationships with their students' families (Arndt & McGuire-Schwartz, 2012; Knight-McKenna & Hollingsworth, 2016). Mary and Veronica created their own videos using the digital software provided by their districts. Families reviewed the recorded lessons for further explanation. If a student missed a live session, they could review the lesson later with their family. If the student were struggling, Veronica would direct the family to go back and watch the recorded videos for additional support. Their videos ranged from read alouds, current lessons covering all subjects, and reviews of past learning objectives.

Veronica asked parents to submit their student's completed work to foster the relationships between the student and their family and the family and the learning process. The partnerships formed between the teacher and each student's family did require the teacher to be flexible and creative, especially for working parents and multilingual parents. Parents were able to submit work via the digital platform their district was using and submit photos via email or Remind. Another display of flexibility was Veronica's decision to offer set activities for the parents. She described these activities as high engagement activities that the student could do at home with typical items; then the parent could take a picture of what the student created and send it to her. Many parents would submit a voice recording or video footage explaining what the student did to complete the activity which relieved their stress because they did not have to upload the work to a digital platform. This intentional parental involvement supports positive

learning outcomes (Ma et al., 2016). The relationship between learning outcomes and family involvement in ECE is positive. Including families in the learning process, Veronica promoted positive learning outcomes for her students.

When the students needed specific materials for live sessions, Veronica let the parents know ahead of time what materials to have. She made sure the items needed could be found in most homes (e.g., cereal, crackers). Regarding learning objectives that she could not observe via live sessions, Veronica recruited the parents' help. For example, for certain social emotional objectives or interacting with peers, she would ask parents to take videos of the student interacting with cousins or neighbors and then use that video for observation. She also limited the number of apps recommended for student use, and the apps she did recommend were individualized to meet the needs of the student.

Observing, Documenting, and Assessing Children's Development and Learning

Using a variety of assessments guides early childhood teachers' instruction, informs curriculum, and gives insight into each child's developmental needs (Yun et al., 2021). This is true with in-person and virtual learning. Mary and Veronica used formative and summative assessments to gain insight into each students' growth. Mary could see her students' responses immediately by using dry erase boards and the chat box during live sessions. She also utilized exit tickets and polls after live sessions to gain insight into each student's understanding. Data were kept regarding sight word recognition, guided reading levels, math fact recognition, along with math tests. Creating science journals while completing science experiments as a class during live sessions also gave Mary insight the levels of success of her various students.

Veronica was able to gauge students' learning using work samples, anecdotal notes, student artifacts, live conversations, and data collected by parents. Fortunately, with the recorded

live sessions, Veronica was able to review them and fill in any missed information. Both Mary and Veronica noted how they would meet with students one-on-one to complete specific assessments. As in brick-and-mortar teaching, the method of assessment used depended on the learning objective and district requirements.

Veronica expanded her assessment to include self-reflection. After a live lesson, Veronica would ask herself a list of questions:

- Was this useful?
- Was it successful?
- What went well?
- What didn't go well?
- Are the children learning?
- How do I know if they're learning?

She realized that if she could not answer these questions, she needed smaller groups or to change her approach. After realizing she could not hear the students, she made smaller groups. "Self-assessing has definitely tried my patience, but I also remember that we are lifelong learners." This process of self-reflection, self-assessment, and adjusting as needed supports student growth and classroom quality by influencing lesson planning and the classroom environment (Zee & Koomen, 2016). In addition, the process of self-reflecting supports teachers' well-being by increasing job satisfaction and lowering stress and potential burnout.

Teaching to Enhance Each Child's Development and Learning

In face-to-face ECE classrooms, teachers foster development and learning through play, cooperative learning, the use of manipulatives, engaging conversations, various group sizes, and individualization (National Association for the Education of Young Children, 2020). Virtual

learning is no different. Mary provided her students with partner work, group work, a time for spontaneous conversations to occur *and* continue, independent work with support, scaffolding during all lessons, and support-focused lessons on the digital platform. She was intentional about not introducing new material via the digital platform lessons. Instead, she reserved new instruction for live sessions and recorded sessions for parental review.

Mary used the state standards and her district-provided curriculum to guide her pace and direction as she taught virtually. "But you need [curriculum and state standards] that are already there, you're not having to go find them, it helps to have a base. And if you want to add something to it, then it helps that creativity to come in with meeting your students' needs." To describe how she continued to keep her virtual 1st grade students on the same pace as the other 1st grade students within her district who were attending in-person, she replied:

> I used differentiated reading and writing groups, explicit direct instruction, modeling and scaffolding, collaborative conversations. I also used Google Slides, Power Point Presentations, Smart Notebook Presentations, all with interactive features. I created video lessons, used YouTube videos, I sent some materials home that accompanied lessons, and I used the digital platform provided by my district.

Veronica created learning experiences instead of direct instruction-driven lessons for her PreK students: "I offered hands-on engaged-type of activities, not just students interacting with an iPad screen." She also explained that due to limited time with her students compared to all day within an in-person learning environment, she paid more attention to providing rich activities that allowed her to see their understanding of content while asking appropriate open-ended questions (see Table 1).

Table 1

PreK Activities with Open-Ended Questions

Activity	Open-Ended Question
Teacher plays music and the students color and draw freely.	Tell me about what you created. Why did you choose those colors?
Bring some blocks to the group. Build freely.	How did you build your structure? Why did you build it?
Bring a favorite book to group.	What would you like to share about your book? Why did you choose this book?

Planning and Implementing and Engaging Curriculum to Achieve Meaningful Goals

Having a lesson plan in the ECE classroom is important yet having an overall culturally responsive teaching philosophy which honors the diversity of learners within the classroom is vital (Bennett et al., 2018). For Mary, she "did it almost just like we would in the classroom. I started with our learning intention, what we were going to learn by asking an open-ended question." Veronica and Mary expressed how diverse their classes were along with a vast range of student abilities. Mary stated that this diversity called for planning and goal setting. She was keen to know when students needed additional support, so she geared the morning live sessions for new instruction and the afternoon sessions to meet the students' needs. She scheduled small group time and made herself available for one-on-one support. Both teachers felt their districts provided the resources they needed to do their jobs and do it well to meet the needs of their students. They expressed how they spent time reviewing the state standards and learning objectives to progress their students to the next grade level. This professional discipline helped them plan well and set individual goals for their students. For example, 2nd grade students need

to use place value to order and compare whole numbers up to 1,000. Mary had a small group of 1st grade students who were not able to order and compare whole numbers 0 to 100 (a 1st grade standard). Mary set up small group sessions to target this math skill to help each student. Veronica and Mary took steps to plan, set goals, and use the curriculum frameworks provided by their districts and states to ensure cohesiveness of their students' overall experience (National Association for the Education of Young Children, 2020).

In addition to planning well and setting goals, Mary's positive attitude towards virtual learning propelled her to try things out of the box:

> And do not be afraid to try different things with your students to give them a little bit of a nudge and a little bit of a push. And you can still engage them. Even if you're not sitting right in front of them.

Intentional positive behavior and positive teacher self-efficacy have shown results in overall psychological well-being specifically connected to increased job satisfaction and decreased stress and burnout (Zee & Koomen, 2016). Veronica expressed her positive attitude while teaching virtually. "Math, language, social, emotional, and social studies--I tried to integrate as much as I could Monday through Thursday. And then Friday was Funday Friday. I did a fun activity with them." Recognizing the need for fun and creative activities benefited the class as a whole (Zosh et al., 2017) because they were able to be more relaxed, interact socially with peers, and apply the skills they had learned. An example of a fun activity Veronica did with her students is a scavenger hunt. During her live Zooms, she would tell her students to go find something in their house that had a circle shape or had their favorite color and bring it back to the group. The students then shared what item was brought to the group and why that item was selected.

Veronica recognized that parts of her district's curriculum and state standards were challenging to complete virtually. For instance, a common PreK curriculum piece and standard related to social skills and the student being able to respectfully work and play with others (Oklahoma State Department of Education, 2016). Veronica modified by using small groups and having students work together to solve a problem or build a structure. Using the materials in her classroom, she would only build the tower as the group members instructed her to do so through a live session. When a problem arose (the tower fell or it did not get as high as it needed to go), she let the students talk it out and come up with a solution together. Veronica chose to "be creative and modify some of it…and it does take time, and it takes some planning." By establishing learning goals, being responsive to the needs of students and families, and being disciplined in their planning, Mary and Veronica provided their students with rich and meaningful learning experiences.

Demonstrating Professionalism as an Early Childhood Educator

ECE teachers are part of a larger profession that extends far beyond the walls of their classroom, including the virtual walls (National Association for the Education of Young Children, 2020). Continuing to stay current on research, advocate for children, and participate in professional development opportunities are just a few ways ECE teachers can demonstrate their professionalism. Mary and Veronica were no different. When faced with the change in teaching platforms, both recognized the need to research and join as many professional development opportunities presented. Veronica expressed the need for teachers to stay current on their practice: "Read, read, read to study up on the latest data and teaching practices. It is the same with technology." Mary also took the time to research: "And there's so much out there now that

we didn't have before. And that's what it's done for me as a professional. It's helped me to think outside the box."

In addition to research, Mary and Veronica also had a positive mindset during professional development. Being a 20-year ECE teaching veteran, Mary described the massive switch to technology use as "Scary at first, but after practice, it actually becomes pretty fun!" Mary also explained that for other teachers to be successful in virtual education, the key was training:

> Training is vital and important, because if you're not used to using technology, like our students are, as you know, they're digital natives. And we aren't…It can seem intimidating. And it can be at first nerve-racking. If you're not for sure you have the competence to know how to use all those tools, training is upmost importance first.

In addition to professional development, Mary and Veronica sought out collaboration. They started meeting with other virtual teachers in their grade levels, some within their districts and some in other districts. Veronica talked about how she practiced live sessions with another teacher to gain confidence and feel comfortable moving all the manipulatives around using the document camera. They bounced ideas off each other and asked what was working well and what was not working. Veronica talked about how teachers need to be open and honest during collaboration times and not be afraid to ask for help. Mary stated that teachers need to

> Be innovative and be creative and the thing is like a lot of my stuff was trial and error. My biggest complaint is whenever we as educators are not given adequate training on the tools necessary to be successful. Anyone preparing to teach virtual, go observe another virtual classroom for the grade you will be teaching.

Prior to the pandemic, Mary and Veronica limited the amount of technology use within their classrooms. Both of their philosophies were very much hands-on and students exploring with various manipulatives. When they changed to virtual teaching, they pulled from their years of experience and positive attitudes to make it a success for their students. They anchored their strategies to DAP to ensure research-based decisions were made. They wanted to honor their philosophies and ensure their virtual classrooms reflected what they have done for years within their in-person classrooms.

Many ECE teachers are still struggling with how to effectively plan and deliver remote instruction with young children. This article has shared strategies from two teachers, organized by the DAP guidelines (see Figure 1), who used their years of in-person teaching experience "to think outside the box," change their delivery methods, and transition their pedagogical approach while teaching virtual. Mary summarized her professional growth during this time: "It's just given me some other tools to reach our kids." Veronica concluded with this powerful statement: "I learned that [technology] can be an enhancement [in early childhood], when used appropriately. There are things that the children can use [in technology] that has given them strengths, and you know, our world has changed." Mary and Veronica provided many examples of how to implement DAP in virtual teaching.

References

Arndt, J. S., & McGuire-Schwartz, M. E., (2012). Early childhood school success: Recognizing families as integral partners. *Childhood Education, 84*(5), 281-285. https://doi.org/10.1080/00094056.2008.10523025

Bennett, S. V., Gunn, A. A., Gayle-Evans, G., Barrera IV, E. S., & Leung, C. B. (2018). Culturally responsive literacy practices in an early childhood community. *Early Childhood Education Journal, 46*, 241-248. https://doi.org/10.1007/s10643-017-0839-9
Gill, B., Walsh, L., Wulsin, C. S., Matulewicz, H., Severn, V., Grau, E., Lee, A., & Kerwin. (2015). Inside online charter schools. Mathematica Policy research. https://files.eric.ed.gov/fulltext/ED560967.pdf

Garcia, E., & Weiss, E. (2020). *Covid-19 and student performance, equity, and U.S. education policy: Lessons from pre-pandemic research to inform relief, recovery, and rebuilding.* Economic Policy Institute. https://www.epi.org/ publication/the-consequences-of-the-covid-19-pandemic-for-education-performance-and-equity-in-the-united-states-what-can-we-learn-from-pre-pandemic-research-to-inform-relief-recovery-and-rebuilding/

Goss, P., & Sonnemann, J. (2017). Engaging students: Creating classrooms that improve learning. Grattan Institute. https://grattan.edu.au/report/engaging-students-creating-classrooms-that-improve-learning/

Haiyudi, H., & Art-In, S. (2021). Parents' involvement in learning assessment during remote learning in pandemic era. *Jurnal Kajian Teknologi Pendidikan, 4*(1), 108-118. https://doi.org/10.17977/um038v4i12021p108

Hancock, C. L., & Carter, D. R. (2016). Building environments that encourage positive behavior: The preschool behavior support self-assessment. *Young Children, 71*(1), 66-73. http://www.jstor.org/stable/ycyoungchildren.71.1.66

Knight-McKenna, M., & Hollingsworth, H. L. (2016). Fostering family-teacher partnerships: principles in practice. *Childhood Education, 92*(5), 383-390. https://doil.org/10.1080/00094056.2016.1226113

Ma, X., Shen, J., Krenn, H., Hu, S., & Yuan, J. (2016). A meta-analysis of the relationship between learning outcomes and parental involvement during early childhood education can early elementary education. *Educational Psychology Review, 28*, 771-801. https://doi.org/10.1007/s10648-015-9351-1

National Association for the Education of Young Children. (2020). Position Statement on Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8 (4th ed.). https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/position-statements/dap-statement_0.pdf

Oberle, E., Domitrovich, C. E., Meyers, D. C., & Weissberg, R. P. (2016). Establishing systemic social and emotional learning approaches in schools: A framework for schoolwide implementation. *Cambridge Journal of Education, 46*(3), 277-297. https://doi.org/10.1080/0305764X.2015.1125450

Oklahoma State Department of Education. (2016). Oklahoma academic standards for English language arts. https://sde.ok.gov/sites/ok.gov.sde/files/documents/files/OAS-ELA-Final%20Version_0.pdf

Remind.com. (2013). *Remind: School Communication* (Version 13.3) [Mobile app]. App Store. https://apps.apple.com/us/app/remind-school-communication/id522826277

United Nations. (2020). Education during COVID-19 and beyond. https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08 /sg_policy_brief_covid-19_and_education_ august_ 2020.pdf

Yun, C., Melnick, H., & Wechsler, M. (2021). *High-quality early childhood assessment: Learning from states' use of kindergarten entry assessments.* Learning Policy Institute. https://learningpolicyinstitute.org/product/high-quality-kea

Zee, M., & Kooman, H. M. Y. (2016). Teacher self-efficacy and its effects on classroom processes, student academic adjustment, and teacher well-being: A synthesis of 40 years of research. *Review of Educational Research, 86*(4), 981-1015. https://doi.org/10.3102/0034654315626801

Zosh, J. M., Hopkins, E. J., Jensen, H., Liu, C., Neale, D., Hirsh-Pasek, K., Solix, S. L., & Whitebread, D. (2017). Learning through play: A review of the evidence. *The Lego Foundation.* https://akcesedukacja.pl/images/dokumenty-pdf/Insight_and_Research/LEGO-Foundation---Learning-through-play---review-of-evidence-2017.pdf

APPENDIX A: PROSPECTUS

Connecting Pedagogy, Technology, and Content in Virtual Early Childhood

A PROSPECTUS

SUBMITTED TO THE GRADUATE FACULTY

in partial fulfillment of the requirements for the

Degree of

DOCTOR OF PHILOSOPHY

By

BRANDY-LEA MCCOMBS
Norman, Oklahoma
2021

Connecting Pedagogy, Technology, and Content in Virtual Early Childhood

A PROSPECTUS APPROVED FOR THE

DEPARTMENT OF INSTRUCTIONAL LEADERSHIP AND ACADEMIC

CURRICULUM

BY

_____

Dr. Vickie Lake, Chair

_____

Dr. Beverly Edwards-Poteet

_____

Dr. Libby Ethridge

_____

Dr. Diane Horm

Table of Contents

CHAPTER 1: INTRODUCTION……6

Background…….….6

Research Problem……...……9

Research Purpose……...…10

Research Questions……...…….…….……...11

Theoretical Framework……...……...……11

Significance of the Study……...……....16

Definition of Terms……17

CHAPTER 2: REVIEW OF LITERATURE..……...19

Technology through the Lens of Early Childhood Education…….…….….19

Technology Challenges Teachers Face.…….…20

Measuring TPACK…….……...23

Virtual Education Performance…...…….....24

Developmentally Appropriate Practice…….….26

Conclusion…….…….…...27

CHAPTER 3: METHODOLOGY…….28

Overview……28

Participants and Setting…….28

Qualitative Data Sources and Procedures…….…….30

Teacher Interviews…….30

Administrator Interviews…….…….30

Open-Ended Responses…….…...….31

Field Notebook…….….…….31

Data Analysis…….31

Trustworthiness…….…….32

Quantitative Data Sources and Procedures……...….32

Teacher Surveys…….33

Administrator Surveys...……33

Data Analysis……...…….……...….…….…...33

Triangulation of Data……...…….…….34

REFERENCES…….…….35

APPENDIX……49

Table 1…...……...….49

Appendix A……50

Appendix B……...…….52

Appendix C…….....56

Appendix D……57

Organizational Timeline……....58

Abstract

Connecting pedagogy and instruction to developmentally appropriate practice is at the heart of teaching. However, when the platform is virtual education, this connection looks different. The invention of the Internet expanded the opportunity for families to receive virtual education ranging from higher education through kindergarten (Kennedy & Archambault, 2012; Palvia et al., 2018). As virtual education continued to grow, questions have been raised at the increase of technology use and pertinent connections to developmentally appropriate practices within early childhood (Molnar et al., 2019; National Association for the Education of Young Children, 2009, 2012). Through COVID-19 (Garcia & Weiss, 2020), the importance of connecting pedagogy, technology, and content to developmentally appropriate practices has never been greater. This mixed-methods study will investigate how virtual early childhood teachers connect pedagogy, technology, and content through developmentally appropriate practices by answering three research questions: How are virtual teachers implementing pedagogy, technology, and content knowledge with young students? How do virtual teachers and administrators assess student learning? How are the implementations considered developmentally appropriate practice? By using the technological, pedagogical, and content knowledge framework (Mishra & Koehler, 2006), surveys will be distributed among virtual teachers and administrators. One-on-one interviews will be conducted to hear directly from virtual early childhood teachers and administrators. This study will contribute to the ever-growing research of virtual education post-COVID-19 (United Nations, 2020).

Keywords: virtual education, early childhood education, TPACK, developmentally appropriate

Chapter 1

Introduction

Background

Due to COVID-19, the education world experienced havoc (Garcia & Weiss, 2020). Approximately 1.6 billion learners in over 190 countries were directly affected by school closings, diverted learning spaces, and alternative instructional delivery methods (United Nations, 2020). COVID-19 forced educators to abandon traditional brick-and-mortar platforms and experience the growing trend of virtual education; virtual school sky-rocketed to 55 million students in the United States alone making it a recognized avenue for students to learn (Garcia & Weiss, 2020).

Public education has used a variety of delivery methods over the years: United States Postal Service (Greenway & Vanourek, 2006; History of Online Schooling, n.d.; Kennedy & Archambault, 2012), local radio stations (Foss, 2020), newspapers, and even television stations (History of Online Schooling, n.d.). Every delivery mode had the same intention: to reach the student within their home. During the 1990s, education had a new delivery mode: the Internet (Kennedy & Archambault, 2012; Palvia et al., 2018). In 1991, Laurel Springs in California began virtual education by using the Internet with the focus to recognize and "honor each child's unique style of learning" (Laurel Springs Schools, n.d.). By 1994, it was one of the first virtual schools in the United States to fully develop online curriculum. Since the 1990s, virtual education has gained momentum and experienced great growth because of the constant expansion of technology and a digitally demanding world (Kennedy & Archambault, 2012; Palvia et al., 2018). Beginning within higher education, influencing secondary, and then residing

in elementary education, virtual education was on course to be an accepted mode of education by 2025 *before* the COVID-19 Pandemic.

As virtual education grows across the nation and globe, research has followed suit. Research shows positive effects related to blended face-to-face learning and online learning for medical training or higher education, however, these findings are limited for K-12 and even more so for preschool (Molnar et al., 2019; Office of Planning, Evaluation, and Policy Development, 2010). Wang et al. (2009) advocated for future research to recognize and verify successful technology designs which implement powerful teacher supports that help children's inquiry-based learning experiences. It was also noted that instructional technologies should be used in early childhood inquiry education. As the defined best practices have been laid out by The National Association for the Education of Young Children (NAEYC, 2009), the whole child is seen and is affected by teaching methods. The use of technology has also increased among early childhood education (ECE) organizations and families, however, awareness about the growing trend of virtual education among ECE teachers has not. Pila et al. (2019) state that only 53% of early childhood educators are familiar with the NAEYC/Fred Rogers Center (2012) published statement highlighting the recommended use of technology in ECE, a 1% increase from 2014.

Due to the growth of technology within society and within ECE (Park & Hargis, 2018), NAEYC and the Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College released a position statement (National Association for the Education of Young Children, 2012). The joint position statement's purpose was to offer support for ECE teachers on when, where, and how to utilize technology for developing students. Furthermore, the statement recognizes that technology and interactive media are not diminishing within society, both are here to stay. Also, the statement reflects the research and guidance of the American Academy of

Pediatrics and the White House Task Force on Childhood Obesity (2010). The position acknowledges technology and interactive media can be used to promote learning and developing *when* used intentionally. The intentional use must be geared to support the individual learning goals of the developing child. The position continues to stress developmentally appropriate practice (DAP) must guide decisions about use and integration of technology within ECE. Professional judgement on behalf of the ECE teacher is necessary to determine if the technology available is appropriate for the age of the child, the individuality of the child including the child's cultural and linguistic development. The position statement recognizes that effective uses of technology and media engage the developing child and promotes hands-on interaction yet, should also provide avenues where scaffolding occurs to support the learning child. NAEYC and Fred Rogers also emphasize the power of play and imagination within the use and incorporation of technology. Finally, still connecting back to DAP, the position statement values technology tools which help strengthen relationships between home and school for the developing child. The position statement concludes with a deep sense of urgency for further research on short-term effects and long-term effects of technology and interactive media use for the developing child.

Even when the platform changes for instruction, one constant remains the same: what optimal developmental practices should be used for students? NAEYC (2009) published guidelines for DAP in a position statement to "promote excellence in ECE" serving children birth through age 8 (2020, p. 1). The guidelines are anchored within five interconnected areas. The first area is establishing a community that fosters relationships among learners and encourages respect for one another. NAEYC then moves onto teaching with the intentionality to boost the child's development and learning through relationships, meeting each student's individual social-emotional, physical, and academic needs. The next area highlights the

curriculum planning with purposeful goals to pull from students' experiences and make connections across all developmental domains. Properly assessing each child's development and learning is the next area NAEYC defines within DAP. Utilizing valid and reliable methods of assessment guides the teacher to provide support, scaffolding, and in specific instances additional help for students in need. The final area focuses upon relationship building among families. NAEYC recognizes the pertinence of family members and educators working together to support the growth and development of the young child. These five separate, yet highly intertwined areas establish the framework designed through research of child development and learning.

Research Problem

A consistent gap within teacher preparation is the pedagogical connection to technology (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019; Vaughan & Beers, 2017). Having the technology devices available for preservice teacher (PST) use and knowing how to use the devices are not the issue. Connecting the technology to the curriculum in rich meaningful ways is where teacher educators are lacking. Kennedy and Archambault (2012) noted that online teaching or virtual teaching and face-to-face teaching in the traditional brick-and-mortar platform are not the same and teacher preparation cannot be the same either. Some researchers have advocated for more synchronous experiences for PSTs and additional professional development for teachers to help combat this problem (Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016).

In 2019 the National Education Policy Center wrote an executive summary on virtual schools in the United States. One of the findings stated there was a "lack of understanding of what is actually happening in virtual education" (Molnar et al., 2019, p. 5). The summary also recommended that policymakers at all levels require virtual schools submit proper information

that demonstrates the effectiveness of the education being provided. The National Education Policy Center concluded that more research is needed on successful student outcomes in virtual education

With the increase in demand for virtual education, comes new demands upon educators (Baran et al., 2011). Roles and expectations of teachers have been changing along with the education platforms. Teachers must rethink and adapt their educational culture, delivery of academics, organization, and teaching methods' while transitioning to virtual education (Howell et al., 2004). Much of professional development for virtual educators is aimed towards technology use or learning new technology. These changes have even influenced PST education to include specific technology training (Alelaimat et al., 2021; Czerkawski, 2014; Pila et al., 2019; Topolovcan et al., 2016). More recently, a push for placing emphasis on professional development focused on the organization's educational goals supporting the use of technology and defining the difference between training geared towards technology and instructional development (Espinet et al., 2020). Just as complex as the educational organizations themselves, so is the demand for professional development.

Research Purpose

The purpose of this research study will be to investigate how virtual ECE teachers connect pedagogy, technology, and content. This perspective will expand current research on practices within virtual education (Molnar et al., 2019). Another dimension of this study is to contribute to the ever-growing virtual education research within ECE, specifically in connection with student growth and lesson success (Alelaimat et al., 2021; Chai et al., 2019; Rizk, 2020). This study will utilize a mixed-methods design to give virtual ECE teachers and administrators the opportunity to share their strategies on pedagogy, technology, and content (Bazeley, 2013;

Miles et al., 2017). The final dimension of this study is to consider the developmental appropriateness of the implementations used by virtual educators.

Research Questions

1. How are virtual teachers implementing pedagogy, technology, and content knowledge with young students?
2. How do virtual teachers and administrators assess student learning?
3. How are the implementations considered developmentally appropriate practice?

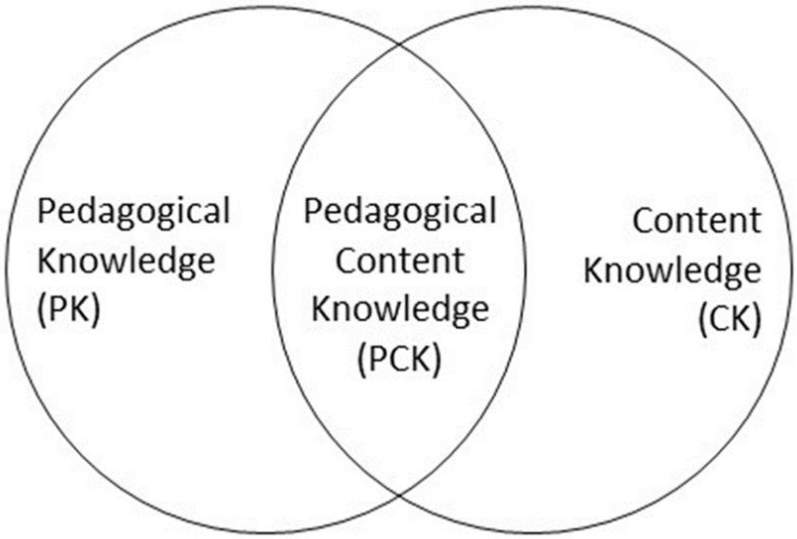
Theoretical Framework

The technological, pedagogical, and content knowledge (TPACK) framework (Mishra & Koehler; 2006) is an additional segment contributing to the overall picture of virtual ECE. When Mishra and Koehler (2006) shared their research and design of the TPACK framework, little did they know the ripple effects of this influential educational concept (Ali et al., 2020; Chai et al., 2010, 2013, 2019; Harvey & Caro, 2017; Koehler et al., 2013; Liu, 2013; TPACK, 2012). They worked together to construct the TPACK model with teacher education programs in mind (Harvey & Caro, 2017). Their vision was for future teachers to understand and gain confidence in technology integration. They envisioned TPACK as the guide that would bring clarification and organization to blend technology between the ever-changing relationships among content, pedagogy, and technology within the classroom (Mishra & Koehler, 2006). Enabling teachers to see these three components separate yet together, Mishra and Koehler believed, would empower teachers to use technology during lessons effectively.

PCK Framework. TPACK was inspired by Shulman's (1986, 2013) pedagogical content knowledge (PCK) framework (Koehler et al., 2013). Shulman divided the knowledge a future teacher must have to succeed in the classroom between content knowledge (CK) and pedagogical

knowledge (PK; see Figure 1). CK is the topic or subject area which is being taught. For an ECE teacher, this could include letter formation, sentence features, or multisyllabic decoding (Oklahoma State Department of Education, 2016). PK is the understanding of the delivery methods for the content knowledge while considering the background knowledge the students have of the content and the students' developmental cognizance (Shulman, 1986, 2013). For example, the ECE teacher could present clay for the student to form letters, blocks with various sentence parts written on, or connect clapping while breaking apart a multisyllabic word; these are various pedagogical approaches used within ECE literacy (National Association for the Education of Young Children, 2009).

Figure 1
PCK Framework



Shulman's work inspired bold competence within teacher education programs and had a profound impact upon PST education research (Angeli & Valanides, 2005; Davis, 2003; Geddis & Wood, 1997; Kinach, 2002; Mecoli, 2013; Schwartz & Lederman; 2002). Geddis and Wood (1997) connected PCK to the mathematics; their case study focused on an experienced teacher

educator's practice in a pre-service mathematics methodology course. Geddis and Wood concluded that teaching is complex and the practitioner's knowledge and understanding of the process are complex. Kinach (2002) also looked to PCK within the realm of mathematics. She derived a cognitive strategy she felt could transfer to any content-related topic within mathematics. Her strategy began with identifying the PST's PCK about the topic being taught. She concluded that the PST's subject-matter knowledge and PCK relate to student achievement and positive relationships. Angeli and Valanides (2005) expanded PCK to include technology (Mecoli, 2013) by designing a model to help elementary PST's use information and communication technology. Through three iterations, Angeli and Valanides (2005) determined their model was sufficient constructing some information and communication technology-related PCK. However, they also concluded that integrating information and communication technology activities with correct pedagogy is difficult and challenging.

Schwartz and Lederman (2002) researched pre-service science teachers and concluded PK alone does not result in effective teaching; teachers also needed the depth of subject knowledge. In comparison, Davis (2003) studied a highly knowledgeable elementary science teacher and concluded that subject knowledge alone did not result in effective teaching. Davis recognized that having subject knowledge is necessary but not sufficient for the instruction to be relevant and adequate. Shulman's (1986; 2013) work prompted numerous studies across multiple curriculum areas to expand the understanding a teacher's powerful relationship with PK and CK (Mecoli, 2013).

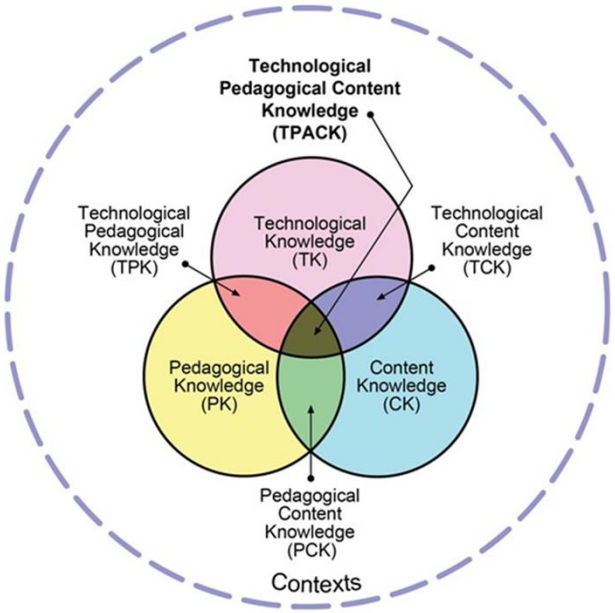
The TPACK framework was the most prominent research expansion from Shulman's work (Koehler & Mishra, 2009; Koehler et al., 2018; Mishra & Koehler, 2006, 2009). By content, pedagogy, and technology interacting with one another and all together, flexible

knowledge is produced for the teacher to blend the use of technology into teaching successfully. Having technology present in the classroom does not make it prone to be used with an educational purpose (Mishra & Koehler, 2009). However, technology does hold the possibility to change educators' perceptions about lesson execution, changing the presentation or even the entire format of the lesson. Yet, using technology for education can be difficult since many of the technological devices and software were not originally designed for classroom use, educators need a specialized form of knowledge: TPACK (Koehler et al., 2013).

TPACK sheds light on the challenge that has perplexed teachers for years (Chai et al., 2013; Koehler & Mishra, 2009; Mecoli, 2013): how to integrate technology appropriately to make it worthy of the students' and teachers' time. Technology-centered professional development sessions and teacher education courses are typically isolated from content knowledge (e.g., literacy, mathematics, or science) and pedagogical connection (Ali et al., 2020; Chai et al., 2013; Koehler & Mishra, 2009). PSTs and in-service teachers are taught how a piece of technology works (e.g., a smartboard or an iPad), but they are not given guidance on how to use the technology effectively for teaching or learning. TPACK theoretically builds bridges connecting these separate areas making a cohesive plan to execute lessons successfully (Mishra & Koehler, 2006).

Figure 2

TPACK Framework



The three main components rooted within the teacher's knowledge are: technology knowledge, pedagogical knowledge, and content knowledge (Koehler et al., 2013; Mishra & Koehler, 2006, 2009). Technology knowledge (TK) consists of *how* the piece(s) of technology work. Pedagogical knowledge (PK) encompasses DAP and involves *how* to teach the specific age. Content knowledge (CK) is linked to the subject-matter being taught: science, mathematics, literacy, etc. Within the framework, these components are valued individually, relationally, and collectively (see Figure 2). Relationally between one another consists of technological content knowledge (TCK), pedagogical content knowledge (PCK), Technological pedagogical knowledge (TPK), the overlapping circles. Collectively together is technological pedagogical content knowledge (TPACK), the center of the framework. The outer dotted line within the image notes the context in the framework is set in, within this study, the context is virtual ECE.

Mishra and Koehler (2006, 2009; Koehler et al., 2013) agreed with Shulman (1986, 2013) that CK is the teacher's knowledge about the subject being taught: the concepts which

make up the subject area, the age-appropriate learning objectives, and the key organization of the learning goals (Chai et al., 2013; Koehler et al., 2013). CK has multiple layers within each concept: the previous skills and concepts the student already learned or mastered and the future skills and concepts which will build upon the current skills and concepts. Mishra and Koehler (2006, 2009; Koehler et al., 2013) also agreed with Shulman (1986, 2013) regarding PK being the teacher's knowledge about how to teach the specific lesson including classroom management, understanding how students learn, and how students construct knowledge (Chai et al., 2013; Koehler et al., 2013). PK goes beyond the content and looks at the student to understand where the student is cognitively, socially, and emotionally. The teacher also uses their PK to look at the entire group of students in their class and navigate the various community dynamics. The area where PK and CK merge (see Figure 1) is when the teacher transforms the subject matter for teaching and learning (Chai et al., 2013; Koehler et al., 2013). Adaptations occur, individualizations to meet students' needs happen, and various ways to represent the material take place. Also, the teacher reads how the students are learning or not learning, changes the teaching approach, and assesses where the students are in learning and comprehension. Overall, a deep awareness takes place between the teacher, the content, and the students where PK and CK come together.

The final aspect of the TPACK framework is the outer-dotted circle labeled *contexts* (see Figure 1), that refers to the various contexts in which teaching occurs (Koehler et al., 2013). For example, context could include the subject being taught (e.g., literacy, science, or a project-based approach unit) or the various dynamics in which the teacher must navigate. Context provides the overall picture as to the lesson being taught.

Significance of Study

With a rapid growth of devices in classrooms post-pandemic (Hughes, 2021; Stone, 2021), teachers are trying to connect their lesson to students through technology (Alelaimat et al., 2021; Rizk, 2020). This study looks at connecting pedagogy to technology use within virtual ECE classrooms of prekindergarten (PreK) through 3rd grade during post-pandemic COVID-19. The purpose of this mixed-methods study is to hear from ECE teachers and administrators about the strategies used to connect pedagogy, technology, and content within the virtual ECE classroom using the TPACK framework (Mishra & Koehler, 2006).

This study will contribute to the research to expand specialized professional development within virtual ECE. Specific training which supports effective virtual instruction is needed within education (Garcia & Weiss, 2020). Research has highlighted the differences teaching virtually and face-to-face (Arias et al., 2018; Buffett Early Childhood Institute, 2020; Redmond, 2011; Roblyer et al., 2009), and this study will add to the current research on how virtual ECE teachers are able to provide effective virtual instruction to their students. This study will also contribute to where teachers are gaining different strategies to use virtually.

Definition of Terms

The following terms will be used in this study:

1. Developmentally appropriate practice(s): framework designed by NAEYC to provide best practice for children ages birth to 8 years; abbreviated DAP (National Association for the Education of Young Children, 2009)
2. Early childhood education: childcare and educational settings for children ages birth to 8 years; abbreviated ECE (National Association for the Education of Young Children, 2009)
3. Face-to-face instruction: teaching content is delivered in person utilizing non-Internet-based methods (Watson & North American Council for Online Learning, 2008)

4. Virtual education: mode of education that uses the Internet to provide a portion or all the student's learning opportunities (National Forum on Education Statistics, 2015)

Chapter 2

Review of Literature

Teachers have voiced great obstacles they have faced along the way to incorporating technology (Kelly, 2015; Koehler et al., 2013; Lim et al., 2013; Mishra & Koehler, 2009; Pila et al., 2019; Tondeur et al., 2016; Topolovcan et al., 2016; Tzuo et al., 2015; Zamir & Thomas, 2019). This literature review connects many pieces of virtual ECE: the technology piece, growth of virtual education in general and within ECE, technology challenges teachers face, measuring TPACK, virtual education performance, and DAP. All components of this literature review guide the direction of the study to reveal any connections on how virtual teachers are implementing developmentally appropriate pedagogy, technology, and content.

Technology Through the Lens of Early Childhood Education

Technology and virtual education have expanded to include ECE students in the classrooms as well as their homes (Alelaimat et al., 2021; Baran et al., 2011; Pila et al., 2019; Vaughan & Beers, 2017). Connected to this growth has been the continued conversation of *how much* technology use and *intentionality* of the technology use are appropriate for ECE children (American Academy of Pediatrics Council on Communications and Media, 2016a & 2016b; American Psychological Association, 2019; Hawkey, 2019; National Association for the Education of Young Children, 2012).

Research has attempted to keep up with the technology surge within ECE. Cicconi (2014) used Vygotsky's social developmental theory which includes the zone of proximal development to support the use of technology in the ECE classroom. Cicconi concluded that instructional technology increases socialization and collaboration among early childhood classmates in math. Hsu et al. (2016) developed a learning model which connected museums outside of the school

organizations directly to the classrooms which expanded the experiences of all students and promoted student learning. Wang et al. (2009) concluded that technology can and should be used in ECE inquiry education based upon how inquiry-based learning activities have the potential for students to construct their own knowledge and using technology this potential is amplified. Technology use has increased across all content areas including reading and writing (Sekeres & Castek, 2016), digital play, and assessment (Edwards & Bird, 2017), and has shown to be successful in 1st grade science tutoring (Hautola et al., 2018).

The awareness about the growing trend of technology and best practice use within the ECE field has not mirrored the escalating growth of use and devices. This is perplexing considering research also shows ECE teachers' technology related knowledge can predict preferences of technology use within the ECE classroom (Tzuo et al., 2015). Pila et al. (2019) also noted if ECE educators' attitudes towards technology was positive, their confidence to use technology was favorable. Additional research by Topolovcan et al. (2016) showed teachers' attitudes toward media and computer self-efficacy are predictors of constructivist teaching while using technology. The more favorable the teachers' attitudes were towards media and self-confidence, the more student-centered learning occurred within the classroom.

Technology Challenges Teachers Face

Teachers face many challenges related to technology (Kelly, 2015; Koehler et al., 2013; Lim et al., 2013; Mishra & Koehler, 2009; Pila et al., 2019; Tondeur et al., 2016; Topolovcan et al., 2016; Tzuo et al., 2015; Zamir & Thomas, 2019). One such challenge is lack of access to technology (Tondeur et al., 2016; Zamir & Thomas, 2019). Tondeur et al. (2016) explained when teachers do not have access to the tools outside of school, their ability to practice, interact, explore, and play with technology also becomes challenging. These hurdles are being described

as the *"digital divide"* and as a result, the teacher professional development must be sensitive to this external factor since teachers may not have access at home and thus teachers feel excluded (Tondeur et al., 2016; Zamir & Thomas, 2019). Tondeur et al. (2016) expressed the challenge teachers face in professional development because of technology itself constantly changing, professional development must change and this alone has challenges of infrastructure, Internet, linguistic differences, and geographical issues (rural areas in comparison to urban areas which have greater Internet bandwidth).

Lim et al. (2013) noted the inconsistency between technology trends within society and technology use within schools is partly connected to lack of technology planning which includes professional development. As technology continues to advance within society, it seems that technology within schools is left behind which has ripple effects through the professional development offered to teachers. Teachers who feel confident with technology report that there are missing professional development pieces to support successful integration within their lessons.

Another challenge for teachers to overcome is self-efficacy and their perceptions about the use of technology (Kelly, 2015; Pila et al., 2019; Topolovcan et al., 2016; Tzuo et al., 2015). Kelly (2015) explained the barriers influencing teachers fall into two categories: first (external such as hardware, software, time, training, support, and the infrastructure within the school) and second-order barriers (internal such as teachers' opinions, standards, vision, perceptions, and personal experience with technology). Overcoming the monstrous obstacle of teachers believing in their own ability to use technology and technology having a relevant pedagogical connection is the greatest challenge of incorporating technology within the classroom.

Pila et al. (2019) reported on the developments of ECE teachers' access to technology and their use of technology. A total of 488 ECE teachers and administrators within programs were surveyed: private and public, for-profit and non-profit, along with school-based, center-based, Head Start, and home-based. Pila et al. reported that a majority of the participants answered with favorable or neutral attitudes toward technology. They also noted the respondents' attitudes reflected the actual use of technology within the classroom: if the educator did not feel technology was useful, it was not used. Topolovcan et al. (2016) also noted a significant connection between teachers' attitudes toward media and frequency of using within teaching. The teachers' sociodemographic characteristics and their personal use of new technology rated not significant.

An additional hurdle teachers must face is knowing how to effectively connect technology to the intended lesson (Koehler et al., 2013; Mishra & Koehler, 2009). Koehler et al. (2013) drew attention to the variety of uses of technology within the classroom (email, software, handheld devices, etc.) based upon each piece of technology design and intentionality. Koehler et al. also recognized the intentionality and variety of use might not be straightforward and possibly require the teacher to rethink how to use the technology effectively within their classroom.

The final overarching challenge teachers face using technology is that the task is daunting (Koehler et al., 2013; Mishra & Koehler, 2009; Zamir & Thomas, 2019). Koehler et al. (2013) brought attention to the challenge a teacher faces acquiring a new skill set and new knowledge, especially when a time restriction is placed on an already busy schedule. Furthermore, if technology use does not align with the teacher's personal pedagogical belief, then it is unlikely to be used. Mishra and Koehler (2009) gave value to the truth that technology is ever-changing, and teachers recognize the rapid changes and see the task at hand as intimidating. Many technology

pieces introduced within the classroom were not designed for education so they require teachers to rethink and restructure them so they can effectively be used within the classroom. This process alone is overwhelming and challenging for many teachers. Zamir and Thomas (2019) noted that teachers are destined for bleak outcomes in education as a result of their lack of ability and time to learn new technology. Through measuring TPACK knowledge, the degree to which connections are made within the various areas can help support teachers navigate these daunting technology tasks.

Measuring TPACK

Schmidt et al. (2009b) recognized the need to design an instrument to assess TPACK for preservice teachers. Looking at the TPACK framework (see Figure 1), there are 7 distinct components which the measurement needed to assess: TK, CK, PK, PCK, TCK, TPK, and TPACK. Schmidt et al. (2009b) began by looking at existing measurements related to these TPACK components and intended populations. One specific area they noted which needed to be the focus of the instrument was the PSTs' self-assessments of the 7 TPACK components, not PSTs' attitudes *towards TPACK*. Once the initial set of items were written and pulled from other measurements, three researchers who have a great amount of expertise in TPACK evaluated for content validity. After revisions, the instrument resulted in 75 items measuring the 7 specific TPACK components and by using a five-level Likert scale (Schmidt et al., 2009a).

Another dynamic of how this measure was tested was through two college courses (Schmidt et al., 2009d; Shin et al., 2009). It was given to the PSTs at the beginning of a specific course within a pretest format and once again at the end of the course in a posttest format. Both courses were designed and taught using the TPACK framework as the guide. At the end of the courses, PSTs showed an increase in TK, TCK, and TPACK. Both studies indicate that the PSTs

expanded their TPACK knowledge and understanding as a result of the specific designed courses. At the conclusion of these studies, the developers felt confident it was ready to use.

The final published "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009a) resulted in confident internal consistency across all 7 TPACK components (see Table 1): the lowest internal consistency of .78 alpha within science CK and the highest internal consistency of .93 alpha within TPK. This instrument has been used across the globe (Hu & Fyfe, 2010; Na et al., 2011; Silva & Morras, 2019) and within specific curriculum content areas (Dorfman, 2013; Fathi & Yousefifard, 2019; Rangel et al., 2016).

Virtual Education Performance

In 2012, the National Education Policy Center began annual reviews of virtual schools within the United States (Miron & Gulosino, 2016; Miron, Shank, & Davidson, 2018; Miron & Urschel, 2012; Molnar et al., 2013, 2014, 2015 2017, 2019, 2021). Over the years, the executive summaries reviewed state-level legislation, school performance, policy, and research evidence of student demographics and achievement. The first report published in 2012 solely focused on the K12 Incorporation, which at the time was the nation's largest virtual school provider (Miron & Urschel, 2012). The researchers of the 2012 report looked to the Annual Yearly Progress to differentiate the school performance ratings given by states. It was noted that these were flawed measures lacking strength yet, these measures were consistent across states. The Annual Yearly Progress indicates whether a school is meeting the state standards. Through the collection of public data, a 25% difference was noted between the virtual schools and the brick-and-mortar schools: 27.7% of K12 schools reported meeting state standards in comparison to 52% of public schools. The researchers noted the year 2012 was not the first year this difference occurred, rather that it had been consistent the previous two years and warrants further research and

attention. Looking at graduation rates, K12 schools had a 49.1% compared to 79.4% for the states which operate K12 schools.

The National Education Policy Center expanded their research to include publicly funded K-12 virtual schools within the U.S. after 2012 (Miron & Gulosino, 2016; Miron, Shank, & Davidson, 2018; Molnar et al., 2013, 2014, 2015 2017, 2019, 2021). The research encompassing 332,379 full-time virtual students during the 2020-2021 school year revealed continued differences within student performance compared to brick-and-mortar students (Molnar et al., 2021). The virtual schools that were operated by state districts had a higher performance rating compared to the charter-operated virtual schools, 50.7% compared to 35.2%. The schools operated by nonprofit Education Management Organizations resulted in the highest performance ratings at 64.3%, the schools operating for-profit Education Management Organizations resulted in the lowest performance rating at 19.4%. The report's findings showed that virtual schools continue to expand rapidly across the nation, and it recommended that federal and state education agencies identify and monitor virtual schools, that performance data should be used to inform funding decisions, and that goals should be set to develop policy for virtual schools specially to improve practice. These targeted recommendations mirror the continued findings of previous years' research by the same organization (Miron & Gulosino, 2016; Miron, Shank, & Davidson, 2018; Miron & Urschel, 2012; Molnar et al., 2013, 2014, 2015 2017, 2019). Another important factor in school and student success is *how* students are being taught.

Keaton and Gilbert (2020) also urged for research on the successful characteristics of online schools and the students who attend them. Nespor and Voithofer (2016) added to that sentiment by stating that state-run public schools who receive failing rankings or have low graduation rates get punished or are forced to close. The continued differentiated performance

ratings of virtual schools stress the need to find out *why* these schools are not performing at the same level as brick-and-mortar schools or why some virtual schools are out-performing brick-and mortar schools (Freidhoff, DeBruler, & Kenedy, 2014; Miron & Gulosino, 2016; Nespor & Voithofer, 2016).

Developmentally Appropriate Practice

DAP is a framework designed by NAEYC to provide the best practice for children ages birth to 8 years (National Association for the Education of Young Children, 2009). The best practice includes methods which foster each child's optimal development and learning. Optimal methods include "strengths-based, play-based approach to joyful, engaged learning," (2020, p. 5). Since play is a common occurrence across all cultures, it can be a powerful fundamental avenue for learning to occur. Play also honors social and cultural contexts the child is influenced by and surrounded by. DAP honors the individuality of each child and supports the unique experience the child has and will have. Finally, DAP recognizes each child's social identities whether they be defined by race, gender, language, family composition, for example.

NAEYC developed nine targeted principles which are distinct yet interconnected with one another, research based, and serve as a framework to support ECE practice (National Association for the Education of Young Children, 2009). The DAP principles honor the interrelations between the developing child and their biological characteristics and their surrounding environment. All five developing domains of the child are supported within the principles and valued: physical, cognitive, social, emotional, and linguistic. Play is deemed as essential for the developing child to experience growth within all budding domains. Variations as a result of individual differences, cultural situations, or personal experiences are considered within each child's progressive development. NAEYC's DAP principles view children as active

learners interacting with their environments and creating meaning with each relationship surrounding them. When a child's environment including the teaching methods and materials used foster a sense of personal connection, purpose, and function, the child has personal motivation to learn. The principles developed by NAEYC also recognize the importance of the ECE teacher having pedagogical knowledge about each subject area the student is learning since students learn and develop across content areas. ECE teachers help the developing child when varying learning opportunities are provided which are just a little beyond the student's current mastery level. The final principle, laying a foundation for DAP, is connected to technology. When technology is used responsibly and intentionally in ECE, it has the potential to be a valuable tool which supports the child's development. It is through these nine principles that ECE teachers can provide optimal learning opportunities for the developing child.

Conclusion

The literature review outlined the vast information and research of virtual education and ECE. Utilizing the TPACK framework, this study will expand current research by investigating how virtual ECE teachers and administrators connect pedagogy, technology, and content and contribute to the ever-growing virtual education research within ECE (Alelaimat et al., 2021; Chai et al., 2019; Rizk, 2020).

Chapter 3

Methodology

Overview

Utilizing a mixed-methods design, this study will give virtual ECE teachers and administrators the opportunity to share their strategies on connecting pedagogy, technology, and content. (Bazeley, 2013; Miles et al., 2017). By using surveys and teacher and administrator interviews this study will explore the following research questions:

1. How are virtual teachers implementing pedagogy, technology, and content knowledge with young students?
2. How do virtual teachers and administrators assess student learning?
3. How are the implementations considered developmentally appropriate practice?

Participants and Setting

Purposeful sampling will be used to select the 1,000 participants based upon three conditions: mode of teaching, overseeing as an administrator, and grade being taught (Merriam & Tisdell, 2016). The 1,000 survey participants must have taught virtually PreK through 12th grade or be an administrator currently overseeing at least one virtual teacher. Interview participants will consist of 20. Ten must have taught virtually PreK through 3rd grade and 10 must be an administrator overseeing these ECE grades. Consent forms (see Appendix A) will be submitted before participation within the study. Pseudonyms will be chosen by the participants or assigned to conceal participants' identity.

Multiple studies have influenced the number of participants for this study (Dong et al., 2015; Joo et al., 2018; Kiray, 2016; Liu, 2013; Park & Hargis, 2018). Park and Hargis (2018) conducted a single-case study with four ECE teachers. Their study was guided with the TPACK

framework and utilized an iPad workshop to discover any progression of the teachers' TK toward TPACK. Four-hundred sixty-seven preservice science teachers were surveyed by Kiray (2016) to develop a TPACK self-efficacy scale. Through the modification suggestions, the factor analysis resulted in the scale being able to measure TPACK self-efficacy perceptions. Liu (2013) focused on six elementary teachers' instructional strategies while they developed TPACK during a professional development program. Through the five months of professional development, the teachers reported an increase in PK, which supported their TPACK. Three-hundred ninety PSTs and 394 in-service teachers were surveyed regarding student-led instructional beliefs and TPACK (Dong et al., 2015). The PSTs' beliefs about student-led instruction do not predict their use of TPACK in the classroom. However, for the in-service teachers, the student-led instructional belief negatively affected their use of TPACK within the classroom. Joo et al. (2018) studied PSTs who intended to use technology within their classrooms. Two hundred ninety-six survey responses indicated their TPACK had strongly correlated with the PSTs' self-efficacy and belief about technology use. However, TPACK did not affect their intentionality of using technology within their classroom.

The settings will vary within this study. Due to snowball sampling (Miles et al., 2017) via various electronic communications, virtual ECE teachers and administrators can participate from all over the globe. The researcher will use email and social media sites to recruit participants. No restrictions will be placed upon participants regarding the school setting (e.g., public, private, charter; urban, suburban, or rural); the only criteria is that the teacher must have taught virtual and the administrator must have overseen a virtual teacher. Since interviews will occur via Zoom, participants' settings will vary from personal homes to classrooms. Demographic

information, education level, and years of experience will be collected at the time of participation (Bazeley, 2013).

Qualitative Data Sources and Procedures

Teacher Interviews. The researcher will use her personal computer and secure Zoom video conferencing to record the 10 participants' responses (Edwards & Holland, 2013). Using a semi-structured interview format (Grbich, 2013), interviews will last approximately 30 minutes. The ECE teachers will be asked about their perception of pedagogical, technology, content, and DAP. Participants will receive questions prior to their scheduled interview (see Appendix C). Teachers will be asked questions within the interviews but will not be limited by response time or direction.

Questions for the interview were formulated based upon "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009a). This published survey was created and revised as a result of multiple attempts to measure PSTs' TPACK and connected areas of knowledge through their own perception and self-assessment (Schmidt et al., 2009b, 2009c, 2009d; Shin et al., 2009). With an internal consistency .93 for TPK, the researcher is confident in using this measure. The TPK questions highlighting this dynamic of the TPACK framework will be used within the interviews. Permission to use the survey was granted by the creators.

Administrator Interviews. A semi-structured interview will occur via a secure video-conferencing platform with the 10 administrators. Interviews will last approximately 30 minutes. Administrators will be asked about their perception of their virtual ECE teachers' connection with pedagogical, technology, content, and measurement of success within virtual education. The administrators will receive questions prior to their scheduled interview (see Appendix D).

Participants will be asked the planned questions but will not be limited by response time or direction. Questions were written based upon "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009a).

Open-Ended Survey Responses. The 1,000 participants will answer nine open-ended survey questions. The questions center around measurable gains, strategies used, and curriculum taught within virtual education. This format will allow each participant the opportunity to freely share their responses connected to their personal experiences (Bazeley, 2013).

Field Notebook. A notebook will be used to review and document the researcher's thoughts and analysis throughout the research (Bazeley, 2013). The researcher will write prior to each interview to organize needed information and after to document responses and demographic information. As the review of literature has already been ongoing, reflections and connections have been documented within the field notebook. The right side of the notebook has been left blank so the researcher could go back to the written notes and analyze the information.

Data Analysis. The open-ended responses of the two sub-groups will be uploaded to Dedoose to be analyzed. During the first round of coding, in vivo, structural, and a priori codes will be used to identify and categorize the participants' responses (Miles et al., 2017). In vivo codes will highlight participants' words, a priori codes come from the four areas within the survey (student performance, teaching strategies, curriculum, and technology) and words pulled from NAEYC's (2009) DAP framework (strengths-based, play-based, engaged learning, individual differences, cultural situations, personal experiences, active learners, interacting with their environments, creating meaning with each relationship, personal connection, purpose, function, and personal motivation to learn), and structural codes will be assigned based on the interview question (Saldana, 2016). Coding will then move into 2nd cycle through evaluation

coding which assigns worth and significance to the participants' comments regarding the previous stated categories. Pattern coding will also be used to group any summaries together. Descriptive topics among the participants will then be aggregated into categories to identify similar or consistent categories.

The researcher will upload all interview audio recordings to Otter.ia for transcription, then compare the typed transcription with the audio recording of each interview and make corrections as needed. Transcripts will be sent individually to each participant for member checking (Bazeley, 2013). After participant approval, transcripts will be uploaded to Dedoose to be analyzed. The researcher will use the same coding framework for the open-ended questions but will also add a priori codes for PCK, TCK, TPK, and TPACK.

Throughout all data analysis, the field notebook will be used to document the researcher's thoughts, connections to literature and within the data, and observations made through the study (Bazeley, 2013). The field notebook will also be used to record the reactions and to reflect on the participant interviews.

Trustworthiness. Establishing validity and reliability are the cornerstones of ethical qualitative research (Merriam & Tisdell, 2016). Ensuring all procedures have been approved through the Institutional Review Board of the University of Oklahoma, the researcher will message qualified participants through email. Upon participant agreement, the researcher will communicate solely through email to establish day and time of interviews and Zoom links. To increase credibility, the researcher will keep an audit trail of data colleting and various strategies used to analyze the data and will utilize member checking (Bazeley, 2013). The researcher will also participate in debriefing meetings weekly with her professor and colleagues to remain up to date on progress and procedures being followed.

Quantitative Data Sources and Procedures

Teacher Surveys. The virtual teachers will answer 19 questions organized within four categories: PCK, TCK, TPK, and TPACK (see Appendix B). Participants will use a 5-point Likert scale for responses ranging from 1 - strongly disagree, 5 - strongly agree, and 3 - neither agree or disagree. The categorical questions derive from the "Survey of Preservice Teachers' Knowledge of Teaching and Technology" (Schmidt et al., 2009a). The next 8 questions are open-ended questions and give them freedom to share their insight about measurable gains, teaching strategies used, and curriculum selection. The participants will then have an opportunity to share if they are willing to participate in a one-on-one interview. The survey concludes with 10 demographic questions.

Administrator Surveys. The administrators will answer the same 19 questions as organized within the Teacher Survey and are written from the perspective of an administrator overseeing at least one virtual teacher (see Appendix B). The same Likert scale will be used and they will also have the opportunity to answer open-ended questions focused on the virtual teachers they oversee regarding measurable gains, teaching strategies, and curriculum selection. The participants will have an opportunity to share if they are willing to participate in a one-on-one interview. The survey concludes with 10 demographic questions.

Data Analysis. The 1,000 virtual educators' survey responses will be separated into 2 participant sub-groups: teacher and administrator. All the responses will be given a weight: strongly disagree will be given the value of 1 and then to 5 for strongly agree (Schmidt et al., 2009a). Each construct will be averaged. The researcher will first run the TPACK construct to explain the variance solely by the PCK utilizing IBM SPSS Statistics (Version 27) predictive analytics software. The TPACK construct will then be run solely by the TCK, and then the TPK

will be run. Control variables such as teacher education and years of experience will be added to explain more of the variance during each iteration. The researcher will then run a multivariate analysis to determine the connection of each PCK, TCK, and TPK with the TPACK and the teachers' certification status, years taught, and education level. Different variables will be controlled to determine if any variance can be explained. The administrators' responses will also go through the same steps to clarify any variance.

Triangulation of Data. The researcher will use triangulation by checking the findings through the literature, surveys, interviews, reflections journal, and field notebook (Bazeley, 2013; Miles et al., 2017). By utilizing these methods, the researcher will be able to gain multiple perspectives. By looking at the data through the qualitative lens, each participant's responses will be valued and their personal experience can be shared. Utilizing the quantitative lens, the opportunity to see if any connections can be made between the participant's survey answers and their open-ended responses exist. This will provide the researcher insight as to what the participant views as PCK, TCK, TPK, and TPACK and how the participant expresses these specialized knowledges. The researcher will use Dedoose to continue to gain perspective and connect to the literature (Miles et al., 2017). The field notebook will be used to collect, review, and process information; bias will also be addressed in the field notebook. The researcher will also seek insight and opinion from ECE teachers who she personally knows.

Contextual information will be included about field work variables in the event of this study being transferred to another study (Miles et al., 2017). Rich description about research methodology will also be included along with participant description. The dependability will be established through reflecting on the literature and interview participants' responses. Member

checking will occur with interview transcripts (Bazeley, 2013). Further descriptions of methods are included in the procedures section.

References

Alelaimat, A. M., Ihmeideh, F. M., & Alkhawaldeh, M. F. (2021). Preparing preservice teachers for teachers for technology and digital media integration: Implications for early childhood teacher education programs. *International Journal of Early Childhood, 52*, 299-317. https://doi.org/10.1007/s13158-020-00276-2

Ali, Z., Thomas, M., & Hamid, S. (2020). Teacher educators' perception of technological and content knowledge on their classroom teaching. *New Horizons, 14*(2), 17-38. https://doi.org/10.2.9270/NH.14.2(20).02

American Academy of Pediatrics Council on Communications and Media. (2016). Media and young minds. *Pediatrics, 138*(5). https://doi.org/10.1542/peds.2015-2591

American Academy of Pediatrics Council on Communications and Media. (2016). Media use in school-aged children and adolescents. *Pediatrics, 138*(5) https://doi.org/10.1542/peds.2016-2592

American Psychological Association. (2019, December 12). Digital guidelines: Promoting healthy technology use for children. CYF News. https://www.apa.org/topics/social-media-internet/technology-use-children

Angeli, C., & Valanides, N. (2005). Preservice elementary teachers as information and communication technology designers: An instructional systems design model based on an expanded view of pedagogical content knowledge. *Journal of Computer Assisted Learnings, 21*(4), 292-302. https://doi.org/10.1111/j.1365-2729.2005.00135.x

Arias, J. J., Swinton, J., & Anderson, K. (2018). Online vs. face-to-face: A comparison of student outcomes with random assignment. E-Journal of Business Education & Scholarship of Teaching, 12(2), 1-23.

Baran, E., Correia, A., & Thompson, A. (2011). Transforming online teaching practice: Critical analysis of the literature on the roles and competencies of online teachers. *Distance Education, 32*(3), 421-439. http://dx.doi.org/10.1080/01587919.2011.610293

Bazeley, P. (2013). *Qualitative data analysis: Practical strategies.* Sage Publications, Inc.

Buffett Early Childhood Institute. (2020). *Professional Learning Guide: Technology Integration in the Early and Elementary Years.* University of Nebraska. https://buffettinstitute.nebraska.edu/-/media/beci/docs/pl_learningguide_tech-early-yrs_12-17-2020-interactive3.pdf?la=en

Chai, C. S., Jong, M., Yin, H., Chen, M., & Zhou, W. (2019). Validating and modeling teachers' technological pedagogical content knowledge for integrative science, technology, engineering and mathemat-ics education. *Journal of Educational Technology & Society,*

22(3), 61-73. https://www.jsotr.org/stable/10.2307.26896710

Chai, C. S., Koh, J. H. L., & Tsai, C. (2010). Facilitating preservice teachers' development of technological, pedagogical, and content knowledge (TPACK). *Journal of Educational Technology & Society, 13*(4), 63-73. https://www.jstor.org/stable/10.2307/jeductechsoci.13.4.63

Chai, C. S., Koh, J. H. L., & Tsai, C. (2013). A review of technological pedagogical content knowledge. *Journal of Educational Technology & Society, 16*(2), 31-51. https://www.jstor.org/stable/10.2307/jeductechsoci.16.2.31

Cicconi, M. (2014). Vygotsky meets technology: A reinvention of collaboration in the early childhood mathematics classroom. *Early Childhood Education Journal, 42*, 27-65. https://doi.org/10.1007/s10643-013-0582-9

Czerkawski, B. C. (2014). Designing deeper learning experiences for online instruction. *Journal of Interactive Online Learning, 13*(2), 29-40. http://www.ncolr.org/jiol

Davis, E. A. (2003). Knowledge integration in science teaching: Analyzing teachers' knowledge development. *Research in Science Education, 34*(1), 21-53. https://doi.org/10.1023/b:rise.0000021034.01508.b8

Dong, Y., Chai, C. S., Sang, G.-Y., Koh, J. H. L., & Tsai, C.-C. (2015). Exploring the profiles and interplays of pre-service and in-service teachers' technological pedagogical content knowledge (TPACK) in China. *Educational Technology & Society, 18*(1), 158-169. https://www.jstor.org/stable/10.2307/jeductechsoci/18.1.158

Dorfman, J. (2013). *Theory and practice of technology-based music instruction.* Oxford Press.

Edwards, S. & Bird, J. (2017). Observing and assessing young children's digital play in the early years: Using the digital play framework. *Journal of Early Childhood Research, 15*(2), 158-173. https://doi.org.10.1177/1476718X15579746

Edwards, R., & Holland, J. (2013). *What is qualitative interviewing?* Bloomsbury.

Espinet, T., Vuong, P. M., & Filback, R. A. (2020). Beyond onboarding: Building a culture of continuous professional development for effective online instruction. In Inoue-Smith, Y., & McVey, T. (Ed.), *Optimizing higher education learning through activities and assessments* (pp. 97-114). IGI Global. https://doi.org/10.4018/978-1-7998-4036-7.ch006

Fathi, J., & Yousefifard, S. (2019). Assessing language teachers' technological content knowledge (TPACK): EFL students' perspectives. *Research in English Language Pedagogy, 7*(2), 255-282. https://doi.org/10.30486/relp.2019.665888

Foss, K. A. (2020). Remote learning isn't new: Radio instruction in the 1937 polio epidemic. The

Conversation. https://theconversation.com/remote-learning-isnt-new-radio-instruction-in-the-1937-polio-epidemic-143797

Freidhoff, J., DeBruler, K., & Kenedy, K. (2014). *Michigan's K-12 Virtual Learning Effectiveness Report.* Michigan Learning Research Institute at MVU. http://www.virtuallearningalliance.org/wp-content/uploads/2014/11/MI-Virtual-Learning-Effectiveness-Report_2013.pdf

Garcia, E., & Weiss, E. (2020). *Covid-19 and student performance, equity, and U.S. education policy: Lessons from pre-pandemic research to inform relief, recovery, and rebuilding.* Economic Policy Institute. https://www.epi.org/ publication/the-consequences-of-the-covid-19-pandemic-for-education-performance-and-equity-in-the-united-states-what-can-we-learn-from-pre-pandemic-research-to-inform-relief-recovery-and-rebuilding/

Geddis, A. N., & Wood, E. (1997). Transforming subject matter and managing dilemmas: A case study in teacher education. *Teaching and Teacher Education, 13*(6), 611-626. https://doi.org/10.1016/s0742-051x(97)80004-2

Grbich, C. (2013). *Qualitative data analysis: An introduction* (2nd ed.). Sage Publications.

Greenway, R., & Vanourek, G. (2006). The virtual revolution: Understanding online schools. Education Next, 6(2), 34-41. https://go.gale.com/ps/anonymous?id=GALE%7CA143817753&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=15399664&p=AONE&sw=w

Harvey, D. M., & Caro, R. A. (2017). Book review: Herring, M. C., Koehler, M. J., & Mishra, P. (Eds.) (2016). Handbook of technological pedagogical content knowledge (TPACK) for educators. (2nd edition). *TechTrends, 61*(4), 404-405. https://doi.org/10.1007/s11528-017-0176-2

Hautola, J., Baker, D. L., Keurulainen, A., Ronimus, M., Richardson, U., & Cole, R. (2018). Early science learning with a virtual tutor through multimedia explanations and feedback on spoken questions. *Education Tech Research Development, 66*, 403-428. https.//doi.org/10.1007/s11423-017-9558-6

Hawkey, E. (2019). Media use in childhood: Evidence-based recommendations for caregivers. CYF News. https://www.apa.org/pi/families/resources/newsletter/2019/05/media-use-childhood

History of Online Schooling. (n.d.). https://www.onlineschools.org/visual-academy/the-history-of-online-schooling

Howell, S. L., Saba, F., Lindsay, N. K., & Williams, P. B. (2004). Seven strategies for enabling faculty success in distance education. *The Internet and Higher Education, 7*(1), 33-49. https://doi.org/10.1016/j.iheduc.2003.11.005

Hsu, T., Kuo, F., Liang, H., & Lee, M. (2016). A curriculum-based virtual and physical mobile learning model for elementary schools in museums. *The Electronic Library, 34*(6), 997-1012. https://doi.org/10.118?EL-08-2015-0146

Hu, C., & Fyfe, V. (2010). Impact of a new curriculum on pre-service teachers' technical, pedagogical and content knowledge (TPACK). In C. H. Steel, M. J. Keppell, P. Gerbic & S. Housego (Eds.), *Curriculum, technology & transformation for an unknown future. Proceedings Ascilite Sydney 2010* (pp.185-189). http://ascilite.org/au/conferences/sydney10/procs/Chun_Hu-concise.pdf

Hughes, J. (2021, January 13). What is the future of education technology? *Keystone Online Studies.* https://www.onlinestudies.com/article/what-is-the-future-of-education-technology/

Joo, Y. J., Park, S., & Lim, E. (2018). Factors influencing preservice teachers' intentions to use technology: TPACK, teacher self-efficacy, and technology acceptance model. *Journal of Educational Technology & Society, 21*(3), 48-59. http://www.jstor.com/stable/26458506

Keaton, W., & Gilbert, A. (2020). Successful online learning: What does learner interaction with peers, instructors and parent look like? *Journal of Online Learning Research, 6*(2), 129-154.

Kelly, D. P. (2015). Overcoming barriers to classroom technology integration. *Educational Technology, 55*(2), 40-43. https://www.jstor.org/stable/44430356

Kennedy, K., & Archambault, L. (2012). Offering preservice teachers field experiences in K-12 online learning: A national survey of teacher education programs. *Journal of Teacher Education, 63*(3), 185-200. https://doi.org/10.1177/0022487111433651

Kinach, B. M. (2002). A cognitive strategy for developing pedagogical content knowledge in the secondary mathematics methods course: Toward a model of effective practice. *Teaching and Teacher Education, 18*(1), 51-71. https://doi.org/10.1016/s0742-051x(01)00050-6

Kiray, S. A. (2016). Development of a TPACK self-efficacy scale for preservice science teachers. *International Journal of Research in Education and Science, 2*(2), 527-541.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education, 9*(1), 60-70.

Koehler, M. J., Mishra, P., & Cain, W. (2013). What is technological pedagogical content knowledge (TPACK)? *The Journal of Education, 193*(3), 13-19. https://doi.org/10.1177/002205741319300303

Laurel Springs School. (n.d.). *About our school.* https://laurelsprings.com/about-our-school/

Lim, C. P., Zhao, Y., Tondeur, J., Chai, C. S., & Tsai, C. (2013). Bridging the gap: Technology trends and use of technology in schools. *Journal of Educational Technology & Society, 16*(2), 59-68. https://www.jstor.org/stable/10.2307/jeductechsoci.16.2.59

Liu, S. (2013). Exploring the instructional strategies of elementary school teachers when developing technological, pedagogical, and content knowledge via a collaborative professional development program. *International Education Studies, 6*(11), 58-68. http://dx.doi.org/10.5539/ies.v6n11p58

Mecoli, S. (2013). The influence of the pedagogical content knowledge theoretical framework on research on preservice teacher education. *The Journal of Education, 193*(3), 21-27. https://doi.org/10.1177/002205741319300304

Merriam, S. B., & Tisdell, E. J. (2016). *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

Miles, M. B., Huberman, A. M., & Saldana, J. (2017). *Qualitative data analysis: A methods sourcebook* (3rd ed.). Sage Publications, Inc.

Miron, G., & Gulosino, C. (2016). *Virtual Schools Report 2016: Directory and Performance Review*. National Education Policy Center. http://nepc.colorado.edu/publication/virtual-schools-annual-2016.

Miron, G., Shank, C., & Davidson, C. (2018). *Full-Time Virtual and Blended Schools: Enrollment, Student Characteristics, and Performance.* National Education Policy Center. http://nepc.colorado.edu/publication/virtual-schools-annual-2018

Miron, G., & Urschel, J. L. (2012). *Understanding and Improving Full-time Virtual Schools: A Study of Student Characteristics, School Finance, and School Performance in Schools Operated by K12 Inc.* National Education Policy Center. http://neps.colorado.edu/publication/understanding-improving-virtual.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 10-17. https://doi.org/10.1111/J.1467-9620.2006.00684.X

Mishra, P., & Koehler, M. (2009). Too cool for school? No way! Using the TPACK framework: You can have your hot tools and teach with them, too. *Learning & Leading with Technology, 36*(7), 14-18.

Molnar, A. (Ed.); Huerta, L., Shafer, S. R., Barbour, M. K., Miron, G., & Gulosino, C. (2015). *Virtual Schools in the U.S. 2015: Politics, Performance, Policy, and Research Evidence.* National Education Policy Center. http://neps.colorado.edu/publication/virtual-schools-annual-2015.

Molnar, A. (Ed.), Miron, G., Barbour, M. K., Huerta, L., Shafer, S. R., Rice, J. K., Glover, A., Browning, N., Hagle, S., & Boninger, F. (2021). Virtual Schools in the U.S. 2021. National Education Policy Center. http://nepc.colroado.edu/publication/virtual-schools-annual-2021

Molnar, A., Miron, G., Elgeberi, N., Barbour, M. K., Huerta, L., Shafer, S. R., Rice, J. K., & National Education Policy Center. (2019). *Virtual Schools in the U.S. 2019.* School of Education. http://nepc.colorado.edu/sites/default/files/publications/Virtual%20Schools%202019.pdf

Molnar, A., Miron, G., Gulosino, C., Shank, C., Davidson, C., Barbour, M. K., Huerta, L., Shafter, S. R., Rice, J. K., & Nitkin, D. (2017). *Virtual Schools Report 2017.* National Education Policy Center. http://nepc.colorado.edu/publication/virtual-schools-annual-2017

Molnar, A. (Ed.); Miron, G., Huerta, L., Cuban, L., Horvitz, B., Gulosino, C., Rice, J. K., & Shafer, S. R. (2013). *Virtual Schools in the U.S. 2013: Politics, Performance, Policy, and Research Evidence.* National Education Policy Center. http://nepc.colorado.edu/publication/virtual-schools-annual-2013

Molnar, A. (Ed.); Rice, J. K., Huerta, L., Shafer, S. R., Barbour, M. K., Miron, G., Gulosino, C., Horvitz, B. (2014). *Virtual Schools in the U.S. 2014: Politics, Performance, Policy, and Research Evidence.* National Education Policy Center. http://nepc.colorado.edu/publication/virtual-schools-annual-2014

Na, R., Zhang, H., Wang, Y., Wang Y., Yoneda, T., & Li, Z. (2011). A study of TPACK structure of outstanding English teacher. Paper presented at the 2017 International Conference of Educational Innovation through Technology (EITT), Osaka, Japan. https://doi.org/10.1109/EITT.2017.78

National Association for the Education of Young Children. (2009). Position Statement on Developmentally Appropriate Practice in Early Childhood Programs Serving Children from Birth through Age 8. https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/position-statements/PSDAP.pdf

National Association for the Education of Young Children. (2012). Position Statement on Technology and Interactive Media as Tools in Early Childhood Programs Serving Children from Birth through Age 8. https://www.naeyc.org/sites/default/files/globally-shared/downloads/PDFs/resources/topics/PS_technology_WEB.pdf

National Forum on Education Statistics. (2015). *Forum guide to elementary/secondary virtual education data.* U.S. Department of Education. National Center for Education Statistics. https://nces.ed.gov/pubs2016/NFES2016095.pdf

Nespor, J., & Voithofer, R. (2016). "Failure" irrelevant: Virtual schools and accountability-immunity. *Teachers College Record, 118*(7), 1-28. http://www.tcrecord.org

Office of Planning, Evaluation, and Policy Development. (2010). *Evaluation of evidence-based practices in online learning: A meta-analysis and review of online learning studies.* U.S. Department of Education. https://www.ed.gov/about/offices/list/opepd/ppss/reports.html

Oklahoma State Department of Education. (2016). Oklahoma academic standards for English language arts. https://sde.ok.gov/sites/ok.gov.sde/files/documents/files/OAS-ELA-Final%20Version_0.pdf

Palvia, S., Aeron, P., Gupta, P., Mahapatra, D., Parida, R., Rosner, R., & Sindhi S. (2018). Online education: Worldwide status, challenges, trends, and implications. *Journal of Global Information Technology Management, 21*(4), 233-241. https://doi.org/10.1080/1097198X.2018.1542262

Park, E. K., & Hargis, J. (2018). New perspective on TPACK framework in the context of early childhood education: The "A" stands for affective. *International Journal of Scholarship of Teaching, 12*(2). https://doi.org/10.20429/ijsotl.2018.120217

Pila, S., Blackwell, C. K., Lauricella, A. R., & Wartella, E. (2019). *Technology in the lives of educators and early childhood programs: 2018 Survey.* Center on Media and Human Development, Northwestern University. https://cmhd.northwestern.edu/wp-content/uploads/2019/08/NAEYC-Report-2019.pdf

Rangel, V. S., Monroy, C., & Bel, E. (2016). Science teachers' data use practices: A descriptive analysis. *Education Policy Analysis Archives, 24*, 86. https://doi.org/10.14507/epaa.24.2348

Redmond, P. (2011). From face-to-face teaching to online teaching: Pedagogical transitions. In G. Williams, P. Statham, N. Brown, & B. Cleland (Eds.), *Changing Demands, Changing Directions.* Proceedings ascilite Hobart 2011. (pp. 1050-160). http://www.ascilite.org.au/conferences/hobart11/procs/Redmond-full.pdf

Rizk, J. (2020). Considerations for implementing emerging technologies and innovative pedagogies in twenty-first-century classrooms. In S. Yu, M. Ally, & A. Tsinakos (Eds.), *Emerging technologies and pedagogies in the curriculum* (pp. 447-460). Springer. https://doi.org/10.1007/978-981-15-0618-5_26

Roblyer, M. D., Porter, M., Bielefeldt, T., & Donaldson, M. B. (2009). "Teaching online made me a better teacher": Studying the impact of virtual course experiences on teachers' face-to-face practice. *Journal of Computing in Teacher Education, 25*(4), 120-126.

Saldana, J. (2016). *The coding manual for qualitative researchers* (3rd. ed.). Sage Publications, Inc.

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

Schmidt, D. A., Baran, E., Thompson, A. D., Mishra, P., Koehler, M. J., & Shin, T. S. (2009). Technological pedagogical content knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers. *Journal of Research on Technology in Education, 42*(2), 123-149. https://doi.org/10.1080/15391523.2009.10782544

Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). The continuing development, validation and implementation of a TPACK assessment instrument for preservice teachers. In *Proceedings of the 2010 Annual Meeting of the American Educational Research Association, Denver, CO*.

Schmidt, D., Baran, E., Thompson, A., Koehler, M., Punya, M., & Shin, T. (2009). Examining Preservice Teachers' Development of Technological Pedagogical Content Knowledge in An Introductory Instructional Technology Course. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen & D. Willis (Eds.), *Proceedings of SITE 2009--Society for Information Technology & Teacher Education International Conference* (pp. 4145-4151). Charleston, SC, USA: Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/31308/

Schwartz, R. S., & Lederman, N. G. (2002). "It's the nature of the beast": The influence of knowledge and intentions on learning and teaching nature of science. *Journal of Research in Science Teaching, 39*(3), 205-236. https://doi.org/10.1002/tea.10021

Sekeres, D. C. & Castek, J. (2016). Collaborative online inquiry: Exploring students' skills in locating, reading, and communicating information. *Journal of Interactive Online Learning, 14*(2), 58-79. http://www.ncolr.org/issues/jiol/v14/n2/2

Shin, T., Koehler, M., Mishra, P., Schmidt, D., Baran, E., & Thompson, A. (2009). Changing Technological Pedagogical Content Knowledge (TPACK) through Course Experiences. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen & D. Willis (Eds.), *Proceedings of SITE 2009--Society for Information Technology & Teacher Education International Conference* (pp. 4152-4159). Charleston, SC, USA: Association for the Advancement of Computing in Education (AACE). https://www.learntechlib.org/primary/p/31309/

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14. https://doi.org/10.3102/0013189x015002004

Shulman, L. S. (2013). Those who understand: Knowledge growth in teaching. *The Journal of Education, 193*(3), 1-11. https://doi.org/10.1177/002205741319300302

Silva, H. T., & Morras, A. S. (2019). Didactic and content technological knowledge of Chilean teachers. *Virtual Campus, 8*(1), 121-138.

Stone, A. (2021, May 19). 3 technology solutions to provide support in the post-COVID-19 classroom. *EdTech: Focus on K-12*. https://edtechmagazine.com/k12/article/2021/05/3-technology-solutions-provide-support-post-covid-19-classroom-perfcon

TPACK (2012). *TPACK Framework.* http://tpack.org/

Tondeur, J., Forkosh-Baruch, A., Prestridge, S., Albion, P., & Edirisinghe, S. (2016). Responding to challenges in teacher professional development for ICT integration in education. *Journal of Educational Technology & Society, 19*(3), 110-120. https://www.jstor.org/stable/10.2307/jeductechsoci.19.3.110

Topolovacan. T., Matjevic, M., & Dumancic, M. (2016). Some predictors of constructivist teaching in elementary education. *Croatian Journal of Education, 18*(1), 193-212. https://doi.org.10.15516/cje.v18i9.2217

Tzuo, P., Toh, L. P. E., & Liang, J. (2015). Early childhood teachers' views towards using constructivist internet-based environments to support children's learning activities: A mixed-methods study. *Australasian Journal of Early Childhood, 40*(1), 81-90. https://doi.org/10.1177/183693911504000111

United Nations. (2020). Education during COVID-19 and beyond. https://www.un.org/ development/desa/dspd/wp-content/uploads/sites/22/2020/08 /sg_policy_brief_covid-19_and_education_ august_ 2020.pdf

Vaughan, M., & Beers, C. (2017). Using an exploratory professional development initiative to introduce iPads in the early childhood education classroom. *Early Childhood Education Journal, 43*, 321-331. https://doi.org.10.1007/s1064301607723

Wang, F., Kinzie, M. B., McGuire, P., & Pan, E. (2009). Applying technology to inquiry-based learning in early childhood education. *Early Childhood Education, 37*, 381-389. https://doi.org/10.1007/s10643-009-0364-6

Watson, J., & North American Council for Online Learning. (2008). Blended learning: The convergence of online and face-to-face education. *Promising Practices in Online Learning.* https://files.eric.ed.gov/fulltext/ED509636.pdf

White House Task Force on Childhood Obesity. (2010). Solving the problem of childhood obesity within a generation. *Office of the President of the United States.* www.letsmove.gov/sites/letsmove.gov/files/TaskForce_on_Childhood_Obseity_May2010_FullReport.pdf

Zamir, S., & Thomas, M. (2019). Effects of university teachers' perceptions, attitudes and

motivation on their readiness for the integration of ICT in classroom teaching. *Journal of Education and Educational Development, 6*(2), 308-326. https://doi.org/10.22555/joeed.v6i2.2712

Table 1

Reliability of Survey of Preservice Teachers' Knowledge of Teaching and Technology

TPACK Domain	Internal Consistency (alpha)
Technology Knowledge (TK)	.86
Content Knowledge (CK)	
Social Studies	.82
Mathematics	.83
Science	.78
Literacy	.83
Pedagogy Knowledge (PK)	.87
Pedagogical Content Knowledge (PCK)	.87
Technological Pedagogical Knowledge (TPK)	.93
Technological Content Knowledge (TCK)	.86
Technological Pedagogical Content Knowledge (TPACK)	.89

Note. Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

Appendix A

Signed Consent to Participate in Research

Would you like to be involved in research at the University of Oklahoma?

I am Brandy McCombs from the Instructional Leadership and Academic Curriculum Department at the University of Oklahoma and I invite you to participate in my research project entitled Connecting Pedagogy, Technology, and Content in Virtual Early Childhood. This research is being conducted via Qualtrics and Zoom. You were selected as a possible participant because you are teaching virtually or you are an administrator overseeing a virtual teacher. You must be at least 18 years of age to participate in this study.

Please read this document and contact me to ask any questions that you may have BEFORE agreeing to take part in my research.

What is the purpose of this research? The purpose of this research is to investigate how virtual early childood education (ECE) teachers connect pedagogy, technology, and technology. This perspective will expand current research on what is occurring within virtual education. Another dimension of this study is to contribute to the ever-growing virtual education research within ECE, specifically the success of virtual lessons and the developmental appropriateness.

How many participants will be in this research? About 1000 people will take part in this research.

What will I be asked to do? If you agree to be in this research, you will participate in an online survey via Qualtrics and if you choose, you will participate in a one-on-one interview.

If you currently teach PreK – 3rd grade virtually and would like to participate in a 30-minute interview via Zoom to further discuss virtual teaching and learning, please type in your email:

If you currently oversee PreK – 3rd grade virtually and would like to participate in a 30-minute interview via Zoom to further discuss virtual teaching and learning, please type in your email:

How long will this take? Your participation will take 30 minutes for the survey and additional 30 minutes if you choose to participate in a one-on-one interview.

What are the risks and/or benefits if I participate? There are no risks and no benefits from being in this research. Employment risks related to accidental data release might occur. All data is saved via password protected files and a separate name to responses cross-reference file is kept separate to ensure no files can be matched to participant's name.

Will I be compensated for participating? You will not be reimbursed for your time and participation in this research.

Who will see my information? In research reports, there will be no information that will make it possible to identify you. Research records will be stored securely and only approved researchers and the OU Institutional Review Board will have access to the records.

You have the right to access the research data that has been collected about you as a part of this research. However, you may not have access to this information until the entire research has completely finished and you consent to this temporary restriction.

Do I have to participate? No. If you do not participate, you will not be penalized or lose benefits or services unrelated to the research. If you decide to participate, you don't have to answer any question and can stop participating at any time.

Will my identity be anonymous or confidential? Your name will not be retained or linked with your responses unless you specifically agree to be identified. Please check all of the options that you agree to:

I agree for data records to include my identifiable information. ___Yes ___ No

I agree to being quoted directly. ___ Yes ___ No

I agree to have a pseudonym reported with quoted material. ___Yes ___ No

What will happen to my data in the future?

After removing all identifiers, we might share your data with other researchers or use it in future research without obtaining additional consent from you.

Who do I contact with questions, concerns or complaints? If you have questions, concerns or complaints about the research or have experienced a research-related injury, contact me at 918.960.1327 or mccombs.brandylea@ou.edu and or Dr. Vickie Lake at vlake@ou.edu

You can also contact the University of Oklahoma – Norman Campus Institutional Review Board (OU-NC IRB) at 405-325-8110 or irb@ou.edu if you have questions

about your rights as a research participant, concerns, or complaints about the research and wish to talk to someone other than the researcher(s) or if you cannot reach the researcher(s).

You will be given a copy of this document for your records. By providing information to the researcher(s), I am agreeing to participate in this research.

Participant Signature	Print Name	Date
Signature of Researcher Obtaining Consent	Print Name	Date
Signature of Witness (if applicable)	Print Name	Date

IRB approval Number #######

Appendix B

Virtual Educator Qualtrics Survey

1. Consent Yes – go to 2; No – go to end of survey "Thank you for your time"

2. Have you ever taught or do you currently teach PreK – 12th grade virtually? Yes – go to 4; No – go to 3

3. Have you ever overseen or do you currently oversee at least 1 virtual PreK – 12th grade teacher? Yes – How many? (Fill in blank) and go to 4 on the administrator path of questions; no – go to end of survey "Thank you for your time"

PCK Questions: On a scale of 1-5; 1 being strongly disagree and 5 being strongly agree with 3 being neither agree or disagree

4. "I can select effective teaching approaches to guide student thinking and learning in mathematics." TEACHER; "The virtual teacher(s) I oversee can select effective teaching approaches to guide student thinking and learning in mathematics" – ADMINISTRATOR

5. "I can select effective teaching approaches to guide student thinking and learning in literacy." TEACHER "The virtual teacher(s) I oversee can select effective teaching approaches to guide student thinking and learning in literacy." – ADMINISTRATOR

6. "I can select effective teaching approaches to guide student thinking and learning in science." TEACHER "The virtual teacher(s) I oversee can select effective teaching approaches to guide student thinking and learning in science." – ADMINISTRATOR

7. "I can select effective teaching approaches to guide student thinking and learning in social studies." TEACHER "The virtual teacher(s) I oversee can select effective teaching approaches to guide student thinking and learning in social studies." – ADMINISTRATOR

TCK Questions: On a scale of 1-5; 1 being strongly disagree and 5 being strongly agree with 3 being neither agree or disagree

8. “I know about technologies that I can use for understanding and doing mathematics.” TEACHER “The virtual teacher(s) I oversee know about technologies that they can use for understanding and doing mathematics.” ADMINSTRATOR

9. “I know about technologies that I can use for understanding and doing literacy.” TEACHER “The virtual teacher(s) I oversee know about technologies that they can use for understanding and doing literacy.” ADMINSTRATOR

10. “I know about technologies that I can use for understanding and doing science.” TEACHER “The virtual teacher(s) I oversee know about technologies that they can use for understanding and doing science.” ADMINSTRATOR

11. “I know about technologies that I can use for understanding and doing social studies.” TEACHER “The virtual teacher(s) I oversee know about technologies that they can use for understanding and doing social studies.” ADMINSTRATOR

TPK Questions: On a scale of 1-5; 1 being strongly disagree and 5 being strongly agree with 3 being neither agree or disagree

12. “I can choose technologies that enhance the teaching approaches for a lesson.” TEACHER. “The virtual teacher(s) I oversee can choose technologies that enhance the teaching approaches for a lesson.” ADMINISTRATOR

13. “I can choose technologies that enhance students’ learning for a lesson.” TEACHER. “The virtual teacher(s) I oversee can choose technologies that enhance students’ learning for a lesson.” ADMINISTRATOR

14. “I am thinking critically about how to use technology in my classroom.” TEACHER. “The virtual teacher(s) think critically about how to use technology in their classroom(s).” ADMINISTRATOR

15. “I can adapt the use of the technologies that I am learning about to different teaching activities.” TEACHER. “The virtual teacher(s) I oversee can adapt the use of the technologies that they are learning about to different teaching activities.” ADMINISTRATOR

16. “I can select technologies to use in my classroom that enhance what I teach, how I teach and what students learn.” TEACHER. “The virtual teacher(s) I oversee can select technologies to use in their classroom(s) that enhance what they teach, how they teach and what students learn.” ADMINISTRATOR

17. “I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.” TEACHER. “The virtual teacher(s) I oversee can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at your school and/or district.” ADMINISTRATOR

18. “I can choose technologies that enhance the content for a lesson.” TEACHER. “The virtual teacher(s) I oversee can choose technologies that enhance the content for a lesson.” ADMINISTRATOR

TPACK Questions: On a scale of 1-5; 1 being strongly disagree and 5 being strongly agree with 3 being neither agree or disagree

19. “I can teach lessons that appropriately combine mathematics, technologies and teaching approaches.” TEACHER. “The virtual teacher(s) I oversee can teach lessons that appropriately combine mathematics, technologies and teaching approaches.” ADMINISTRATOR

20. “I can teach lessons that appropriately combine literacy, technologies and teaching approaches.” TEACHER. “The virtual teacher(s) I oversee can teach lessons that appropriately combine literacy, technologies and teaching approaches.” ADMINISTRATOR

21. “I can teach lessons that appropriately combine science, technologies and teaching approaches.” TEACHER. “The virtual teacher(s) I oversee can teach lessons that appropriately combine science, technologies and teaching approaches.” ADMINISTRATOR

22. “I can teach lessons that appropriately combine social studies, technologies and teaching approaches.” TEACHER. “The virtual teacher(s) I oversee can teach lessons that appropriately combine social studies, technologies and teaching approaches.” ADMINISTRATOR

OPEN ENDED QUESTIONS

23. What measurable gains do you have within your virtual teaching? TEACHER What measurable gains do the virtual teachers you oversee have? ADMINISTRATOR

24. How do you know if your strategies are working? TEACHER How do you know if the teaching strategies the virtual teacher(s) used are working?

25. How do you know the students are learning? TEACHER How do you know the students are learning? ADMINISTRATOR

26. What strategies do you use to teach the content? TEACHER What strategies do the virtual teacher(s) you oversee to teach the content? ADMINISTRATOR

27. What methods do you use to teach the content? TEACHER What methods do the virtual teacher(s) you oversee to teach the content? ADMINISTRATOR

DEMOGRAPHIC SECTION

1. Highest level of education: OPEN ENDED

2. Type of teaching certification(s) held: OPEN ENDED

3. Path of certification: Traditional, emergency, alternative, or other_____

4. Years you have taught virtual_____ . TEACHER Years you have overseen virtual education_____ ADMINISTRATOR

5. Have you taught in person before? Yes How many years? No. Go to next question.

Have you overseen in person teachers before? Yes How many years? No. Go to next question.

6. What grade(s) have you taught virtually? What grades have you overseen virtually?

7. Is your school categorized as public, private, or charter?

8. What is your age?

9. What is your gender?

10. What is your ethnicity?

END OF SURVEY: THANK THEM FOR THEIR TIME

[1]Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

Appendix C

ECE Virtual Teacher Interview Questions

Interview questions: *Participants have already completed the survey*

1. Tell me about some of the effective teaching strategies you use to guide student thinking and learning in your classroom.

2. How do you select these teaching strategies?

3. Tell me how these strategies are supported by the technology you use.

4. Tell me about any professional development that has helped you?

5. How did you receive this professional development?

6. Was the professional development something you sought on your own or was it offered to you?

7. How do you measure student success in virtual education?

8. What are the tools teachers need to be successful in virtual education?

9. Are you using specific apps for individualization?

10. Talk about the process and how it helped you or not helped you.

11. Are you supporting other virtual teachers or mentoring them? What are some ways you are doing this?

[1]Schmidt, D. A., Baran, E., Thompson, A. D., Koehler, M. J., Mishra, P., & Shin, T. (2009). *Survey of preservice teachers' knowledge of teaching and technology.* Iowa State University.

Appendix D

ECE Virtual Administrator Interview Questions

Interview questions: *Participants have already completed the survey*

1. Tell me how the virtual teachers select effective teaching strategies to guide student thinking and learning within the classroom.

2. Tell me how these strategies are supported by the technology the virtual teachers use.

3. Tell me about any professional development that has helped the virtual teachers you oversee.

4. How did the virtual teacher(s) receive this professional development?

5. Was the professional development something the virtual teacher(s) sought after on their own or was it offered to them?

6. How do the teachers you supervise measure success in virtual education?

7. What are the tools you feel teachers need to be successful in virtual education?

8. Are the teacher(s) you oversee using specific apps for individualization?

9. Have the virtual teacher(s) you oversee been mentored before as a virtual teacher?

10. Have the virtual teacher(s) you oversee mentored another virtual teacher?

11. How are you supporting virtual teachers or providing advice for them? What are some ways you are doing this?

Organizational Timeline

- October
    - Defend Prospectus
    - Submit IRB for approval
    - Obtain Survey Participants
    - Conduct and Transcribe Interviews
    - Data Analysis
- November
    - Conduct and Transcribe Interviews
    - Data Analysis
- December
    - Data Analysis
    - Begin Conceptual Article for *Journal of Computer Assisted Learnings*
- January
    - Finish Conceptual Article
    - Begin Empirical Article for The *Journal of Early Childhood Research*
- February
    - Apply for Graduation
    - Finish Empirical Article
    - Begin Practitioner Article for *Early Childhood Education Journal*
- March
    - Finish Practitioner Article
- April:

    - Submit Dissertation to Committee
    - Submit Degree Check (online)
    - Submit Request for Authority to Defend
    - Complete Dissertation Defense
- May
    - Close IRB